ELECTRICAL WORLD

A McGRAW-HILL PUBLICATION

MAY 7, 1949 ISSUE

ELECTRICAL WORLD 1874 1949 OUR 75TH YEAR

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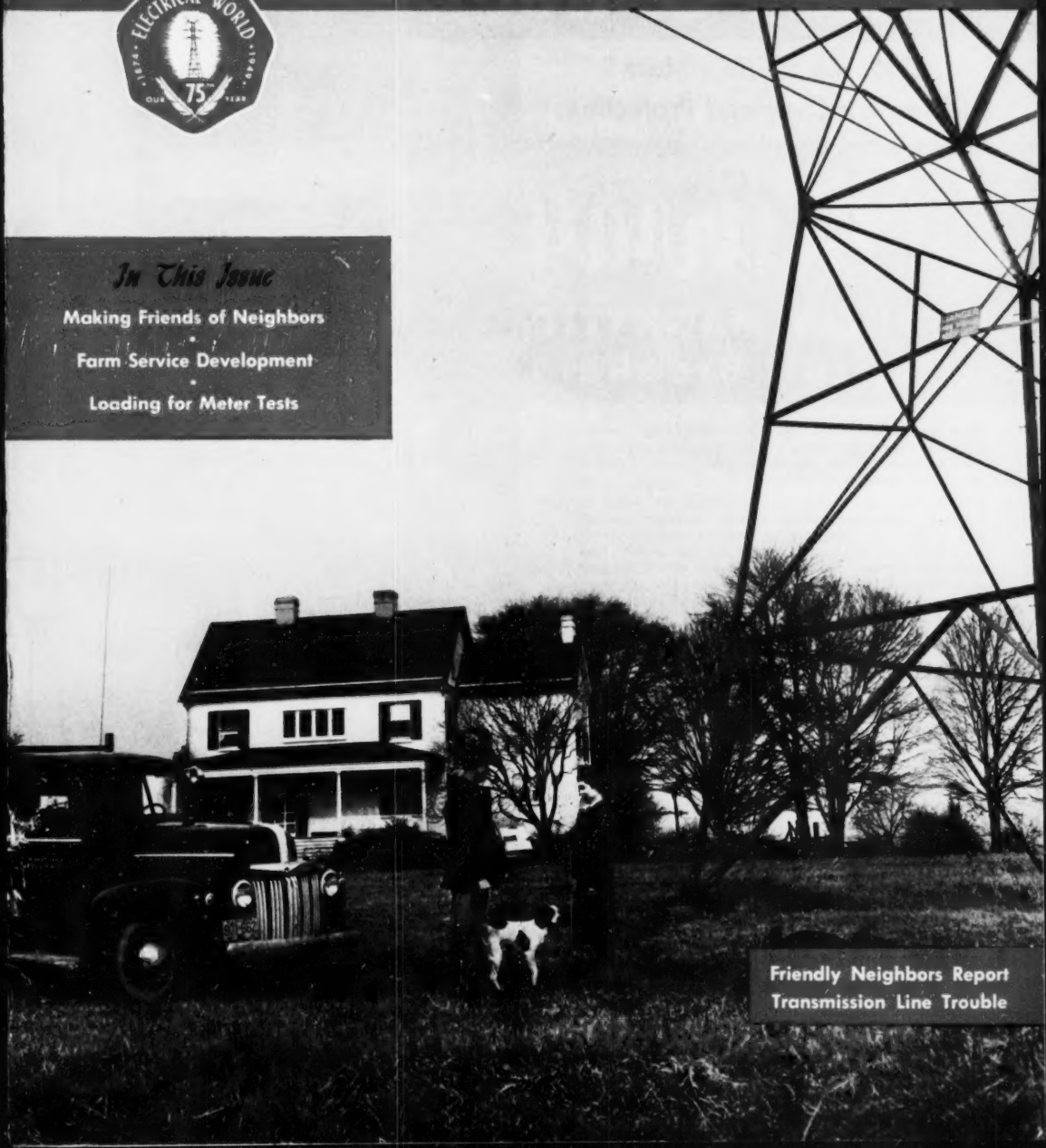


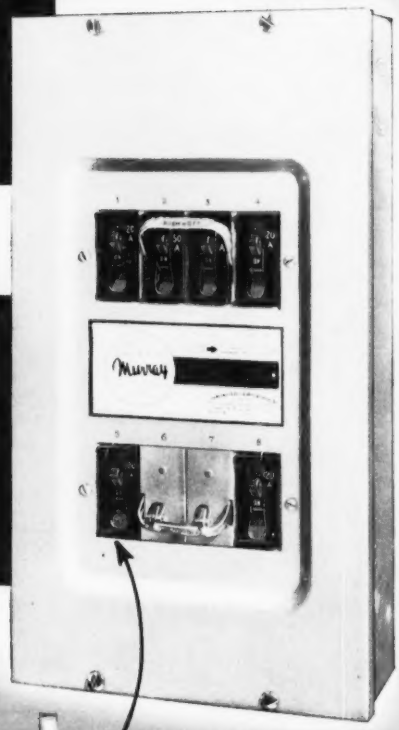
Friendly Neighbors Report Transmission Line Trouble

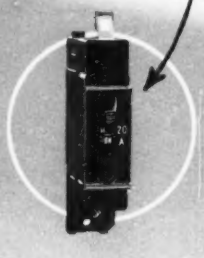
Murray
MODERN METHODS *mean Highest Quality . . . Latest Design . . . Greatest Value!*

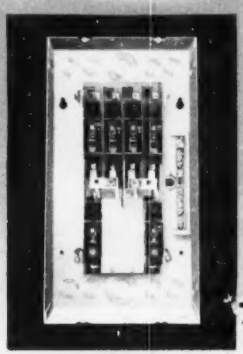
8 Circuits *in* 1 Load Center

With the World's Most Satisfactory Overload Protection:

Murray
FULLY MAGNETIC Circuit Breakers







Eight branch circuits are controlled and protected by this NEW Murray Magnetic Circuit Breaker Load Center. Utmost flexibility is achieved by *individually interchangeable* single pole breakers rated at 10 to 50 amp. Range Circuits can be accommodated by 35 or 50 amp. circuit breakers. Surface or flush mounting.

Now you can anticipate two of tomorrow's needs today: (1) more circuits, (2) better protection against overloads. Both requirements are met in the NEW Murray 8 Circuit Magnetic Breaker Load Center!

This modern new equipment brings you the latest in satisfactory overload protection — at moderate cost. As few as four breakers need be installed with the panel . . . more can be added as circuits are added! Any *individual* breaker can be interchanged with a breaker of different rating — making possible unlimited combinations, right on the job . . . and the only tool needed is a screwdriver!

In addition, each Murray *Fully Magnetic* Circuit Breaker is virtually an electrical engineer at the switch! Just see what it does: It carries full rated load indefinitely — no *derating necessary*. It accommodates heavy momentary overloads — even when carrying full rated current. Yet it trips reliably, in a reasonable time, under sustained overloads. It interrupts the circuit almost instantaneously under "short circuit" conditions. *And because it has no thermal element, it is virtually unaffected by ambient temperature changes!*

Yes, you can equip today for the loads of tomorrow — and for tomorrow's exacting standards of overload protection—with the NEW Murray 8 Circuit Magnetic Breaker Load Center. For full details, contact your Murray representative, or write

FOR TOMORROW'S LOADS . . .
Equip Today!

Murray MANUFACTURING CORPORATION

50 Years of Service to the Electrical Industry
1250 ATLANTIC AVENUE • BROOKLYN 16, NEW YORK

SERVICE ENTRANCE & METER EQUIPMENT • MAGNETIC CIRCUIT BREAKERS
SWITCHES • CURRENT LIMITING REACTORS • CROWS'NEST AERIAL LADDERS

ELECTRICAL WORLD

Published for 75 years for those engaged in the business of generating, transmitting, distributing or applying electric power

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COVER PICTURE—Pennsylvania Water & Power Co is helped by home owners living near its transmission lines to spot unusual conditions or potential trouble

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1 SIMPLE DESIGN with 9 IMPORTANT ADVANTAGES meets 10 CABLE REQUIREMENTS

HAZARD'S VERSATILE HAZASHEATH

CABLE DESIGN

a Hazaloy-coated conductors prevent corrosion.

b Hazard Watertite Submarine Insulation is a rich, rubber compound, formulated especially by Hazard to assure superior service in moist locations. Strong, resilient and moisture-resistant, it has proved its durability and dependability for over 20 years under the toughest operating conditions.

c Hazaprene Sheath is applied in a single layer and uniformly vulcanized to provide a tough, resilient, long-lived protective covering. Made with neoprene, Hazaprene successfully withstands sunlight, weather, moisture, acids, chemicals, etc.

ADVANTAGES

1 No ducts required when buried
2 Light in weight
3 Flexible
4 Economical
5 Wear-resistant
6 Flame-resistant
7 Easy to install
8 Simple to splice and terminate
9 No magnetic sheath losses

APPLICATIONS

1 Series street lighting
2 Airport lighting
3 Industrial power lines
4 Underground distribution
5 Building entrances
6 Rural wiring
7 Highway lighting
8 Municipal signal wiring
9 Bridge wiring
10 Athletic field lighting

Whether buried direct, run in ducts, or strung overhead, Hazasheath has all the necessary protection built in so that safe, trouble-free, long-lived circuits are assured. For all the facts about this outstanding Hazard cable, write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.

HAZARD

7477

insulated wires and cables for every electrical use

TOP LINES
for all lines
... are available from Graybar
For distribution or transmission lines — construction or maintenance — Graybar has all the *supply* lines you need. You can count on every item, because Graybar's standards of selection are tough! Everything Graybar distributes is a product of a leading manufacturer. Its efficiency and reliability have been tested, proved, and improved through years of research and field service.
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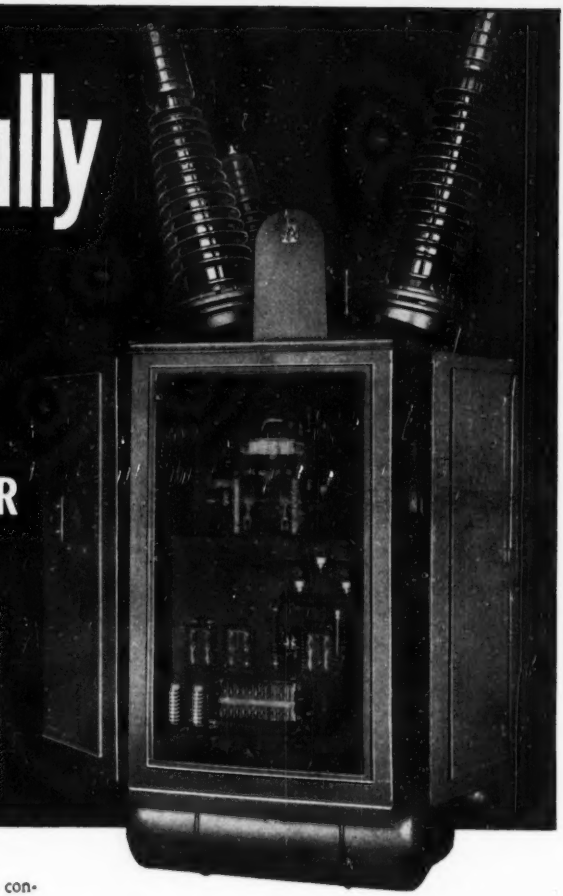
Graybar-selected poles — full-length pressure-treated pine and fir; and full-length pressure-treated, butt-incised cedar. Rainier fir crossarms that have the proven strength and durability to resist taxing combinations of heavy conductor load and shock from snow, ice, and wind.
Wire, strand, hardware
Crapo strand and high-strength static wire to fit your specifications . . . Hubbard braces, brackets, and racks for long-lasting pole structures . . . Chance pole anchors for guying of all types . . . Reliable connectors for quick, secure tap-offs . . . rugged O-B insulators . . . and everything else the project requires!
ALL THE TOOLS, TOO!
Help your linemen do each job quickly, efficiently, and safely — supply them with all the proper tools. Graybar has everything from pliers and rubber gloves to FWD line trucks. To round out our complete service, there is a Graybar Outside Construction Specialist to consult with you on any special problem "from the bottom of the hole to the top of the pole." *Graybar Electric Company, Inc. Executive Offices: Graybar Building, New York 17, New York.* 4955
You get the best of everything electrical
Via GraybaR
IN OVER 100 PRINCIPAL CITIES

Mechanically Trip-Free

PNEUMATIC OPERATOR

MEANS BEST PROTECTION FOR YOUR EQUIPMENT

INSTANT BREAKER OPERATION UNDER ALL FAULT CONDITIONS



MECHANICALLY TRIP-FREE action instantly releases contacts from closing force when closed on a fault . . . permits high contact acceleration unhindered by closing cylinder back-pressure or toggle inertia. You get instant, complete contact opening under all tripping conditions.

With this powerful Allis-Chalmers electro-pneumatic operator, highest possible system stability and service continuity are maintained. The breaker cannot be held closed on a fault . . . and operator mechanism is quickly recoupled to permit fast reclosing—within 20 cycles. Pneumatic operation furnishes reliable, high-speed contact closing economically — requires only fractional horsepower motor.

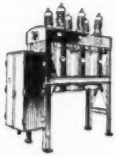
This *mechanically trip-free* electro-pneumatic operator is just one of many features you get on Allis-Chalmers oil circuit breakers. For details on any rating, contact your nearby A-C representative. Or write direct. A 2625

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

IT'S STANDARD EQUIPMENT ON THESE ALLIS-CHALMERS OIL CIRCUIT BREAKERS

TYPE BZO-160
. . . 69 to 230 kv — 3- or 5-cycle opening, 20-cycle reclosing

TYPE FZO-151
. . . 69 kv . . . frame-mounted—5- or 8-cycle opening, 20-cycle reclosing.



TYPE FZO-150
. . . 15 to 46 kv—8-cycle opening, 20-cycle reclosing

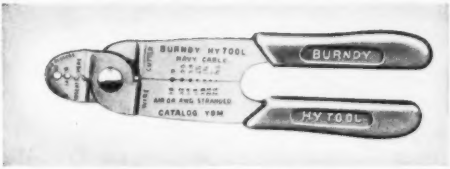
ALLIS-CHALMERS

Pioneers in Power and Electrical Equipment from Generation through Utilization

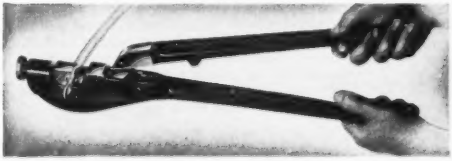
Tools that replace the Torch...

Burndy Hydraulic Hypress—Y34-A. Hand-operated—weight 9 lbs.; 18,000 lbs. pressure; for conductors No. 6 through 500 Mcm. Used to install Hylugs, Hylinks, Hytaps and overhead Hysplices

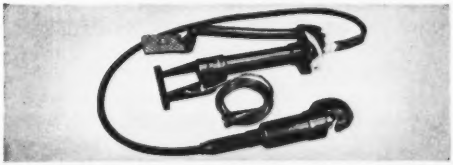
BURNDY
Hytools and Hypresses



Burndy All-Purpose Hytool—Y9M. Hand plier with wire cutter and stripper. For conductors No. 22 through No. 10.



Burndy Hytool MY29. Hand-operated—for conductors No. 8 through 4/0 without change of dies.



Burndy Hydraulic Hypress—Y34-B. Foot-operated type; 18,000 lbs. pressure; for conductors No. 6 through 500 Mcm.

WHY fuss with solder when making electrical connections? Efficient, rapidly operated Burndy HYTOOLS and HYPRESSES indent one-piece, pure copper HYDENT connectors onto all conductors from #22 through 2000 Mcm.

With this modern HYDENT connecting method you assure uniform depth of indent, and *strong, efficient electrical connections, every time.* But more, you make substantial savings on *every* connection. You just insert the conductor into the connector barrel, and indent with the HYTOOL. *Nothing simpler . . . nothing quicker . . . nothing surer!*

No matter what your requirement, Burndy has the right tool for your connecting needs . . . hand, portable or bench types; manual, hydraulic or pneumatic operation. Get all the facts. Send for Burndy HYDENT Catalog Y46 today.

Hylugs—Hylinks—Hysplices are a few of the many Hydent connectors.

Connect with
BURNDY

New York 54, N. Y.
WESTERN BRANCH: Vernon 11, California
CANADA: Canadian Line Materials, Ltd., Toronto 13

YOUR CENTRAL CONDUIT DISTRIBUTOR WORKS HARD AT KEEPING

Everybody Happy!

The great demand for conduit has made it difficult for your distributor to satisfy everyone's requirements completely. But your Central Conduit Distributor works hard and faithfully at trying to keep everybody happy. He makes every effort to fairly divide his available supply of conduit among his customers. This often means extra deliveries which increase his overhead . . . but he's glad to do it, just so all of his customers get a fair share of his supply.

We, too, are trying to expedite your orders by trying every way we know how to produce greater quantities of Central Rigid Steel Conduit. But even these efforts have not been enough to keep pace with the tremendous demand for Central Rigid Steel Conduit. However, we shall continue to produce as much conduit as we possibly can. We know that's the best way we can help your distributor get what you want when you want it.

SPANG-CHALFANT

Division of The National Supply Company

General Sales Office: Grant Bldg., Pittsburgh, Pa.

District Offices and Sales Representatives in Principal Cities

CENLACO a hot dipped galvanized and lacquered finish, inside and out.

CENTRAL WHITE electro-galvanized outside and black enameled inside.

CENTRAL BLACK permanent, baked-on black enamel finish, inside and out.

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

"We eliminated load checks costing $12 a piece"

The way this southern utility uses Westinghouse "CSP"* transformers to eliminate load checks is a prize example of the moneysaving features in these Completely Self-Protecting units.

With many thousand "CSP" transformers on 7,200 volt lines, their records show this comparison:

On conventional transformers, they fused for a minimum of 200% of load, but changed the transformer to a larger size when the load reached 150% of the rating. This load was determined from (1) a specific load check, (2) specific knowledge of added load or (3) records of abnormal fuse outages. It cost $6 to replace a fuse, and approximately $12 to make a load check. Since a transformer would not be changed on just one fuse outage, there was always a minimum total cost of $12 for a load check.

With "CSP" transformers, they use the red signal light as a positive indication that the limit of safe *thermal* loading has been reached.

You can be sure of this: Using "CSP" signal lights instead of making expensive load checks cuts operating costs. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70523-A

**Trademark—Reg. U. S. Pat. Off.*

WANT MORE FACTS? Here are 36 pages of product information you'll want to have about Completely Self-Protecting transformers. Covers construction, operation, mounting and servicing. Ask for B-4249.

Call the Westinghouse Salesman

WESTINGHOUSE

Westinghouse "CSP" TRANSFORMERS

SINGLE PHASE THREE PHASE BANKED SECONDARY

Booked FOR

To keep inflation out of power costs in the face of steadily rising construction and fuel costs, electric utilities are showing a growing preference for one-boiler-per-turbine operation when providing additional generating capacity.

Success of this type of operation calls for an extremely reliable supply of steam—boilers that will stay on the line day after day, month after month.

That B&W boilers are fully measuring up to this exacting requirement is indicated by the fact that 79 units for one-boiler-per-turbine applications *without high-pressure cross connections*, are now in service or on order. Together these units supply the steam requirements for over 4,600,000 kw. of generating capacity. Operating records show that most of these boilers are giving uninterrupted service for eleven months or more, being taken out of service only for the required annual inspections.

Perhaps the answer to your power cost problem is one-boiler-per-turbine operation with dependable B&W steam.

79 "SOLO" PERFORMANCES

BABCOCK & WILCOX

G-400

COMING THROUGH!

Simplex Paper-Insulated Cables ARE "DELIVERING THE GOODS" WHERE LARGE AMOUNTS OF POWER MUST BE TRANSMITTED AT HIGH VOLTAGES

And little wonder. For only the finest in design, materials, and workmanship goes into the manufacture of Simplex Paper Cables . . .

. . . Paper insulation that features high dielectric strength, low dielectric losses and low power factor, and which can be used at copper temperatures up to 85° C., depending on the operating voltage.

. . . Impregnating oil that is free of gas, moisture, and impurities.

. . . Metallic shielding or belting to best meet the conditions under which the cables must operate.

. . . Lead sheaths which, through sound foundry practice and careful extrusion, are unimpaired by oxides, poor welds and eccentricity.

All add up to performance that's trouble free; performance you can depend on.

Simplex Paper Cables are made in single or multi-conductor types, protected by a lead sheath alone, or by a lead sheath with wire armor or a reinforced rubber jacket. They are suited for use in underground, aerial, and submarine installations. Write us at the below address for full details.

SIMPLEX WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

ECONOMICAL PROTECTION

You can save money-by using the

R&IE

Type MB or MBH RECLOSER for SUBSTATION CIRCUIT PROTECTION

R&IE AUTOMATIC CIRCUIT RECLOSER brings transmission type of service-restoration to distribution centers.

CHECK the FACTS

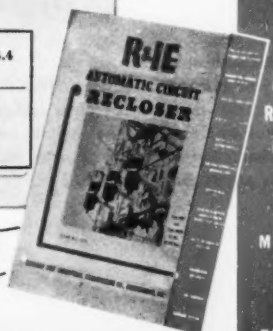
1. Reduces service costs by preventing unnecessary fuse blowing.
2. Provides full protection to wires and equipment.
3. Greater accuracy through mechanical timing—free from temperature error.
4. Coordinates with (several) secondary fuses.
5. Permits normal fusing for selective clearing of overloads and short circuits.
6. Selects with substation overcurrent relays.
7. Handles high load currents—up to 250 amperes.
8. Provides high interrupting capacity up to 6000 Amps.

TYPE MB AND MBH INTERRUPTING RATINGS

Continuous Duty Rating of the Recloser in Amperes	Type MB 2.1—4.16 Kv	Type MB 4.8 Kv	Type MB 6.9—8.32 Kv	Type MB 12.0—14.4 Kv
60	2000	1500	1500	1500
100	3000	2500	2500	2000
160	5000	4000	4000	2000
200	6000	5000	4000	2000
250	6000	5000	4000	2000

Type MBH

Full data on Type MB and the new Type MBH—Bulletin 1371



RAILWAY and INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

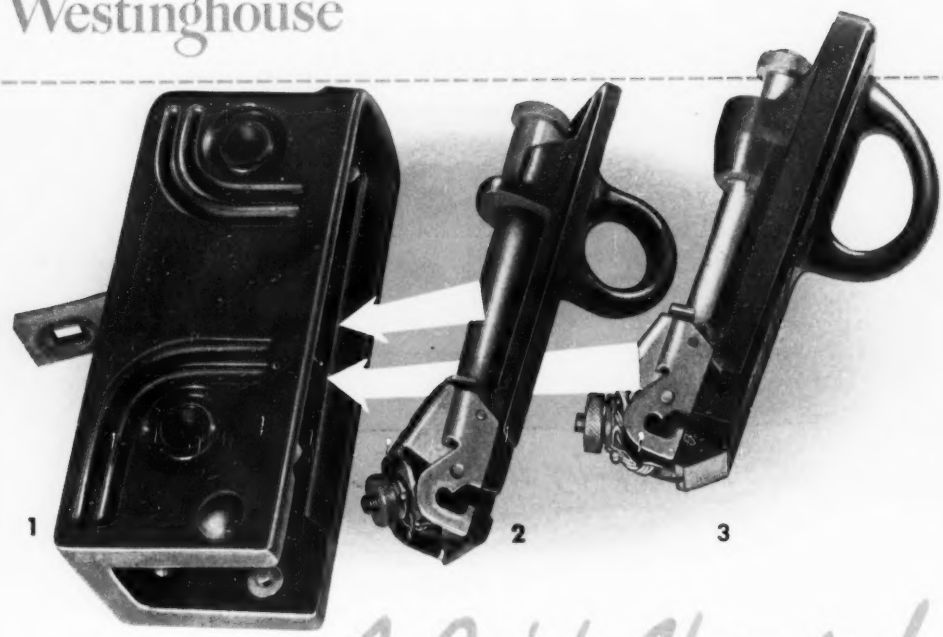
AFFILIATED WITH THE I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.
IN CANADA — EASTERN POWER DEVICES LIMITED, TORONTO

The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- HORN GAP SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- DISTRIBUTION EQUIPMENT
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
- OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES
- KIRK INTERLOCK SYSTEMS
- AUTOMATIC RECLOSING EQUIPMENT
- METAL CUBICLES
- TESTING DEVICES

YOU CAN BE **SURE**.. IF IT'S

Westinghouse



A Quick Changer!

...for fast re-fusing..for future expansion

Interchangeability keynotes Westinghouse porcelain-enclosed cutouts. Only Westinghouse gives you this versatility in line protection. Consider what this means:

First, fuse replacements are fast . . . safe . . . easy. Lineman removes door with hookstick—replaces it with a fused door. Fuse links can be replaced at the truck or in the shop.

Second, as line capacity outgrows the cutout interrupting rating, the EA cutout door may be replaced with the new Type HC (high interrupting capacity) door—either dropout or non-dropout type. That's because *any* door will fit *any* housing.

In addition, you get greater safety; complete hookstick operation; 180° dropout for clear indication of blown fuse; cool operation; light weight combined with great mechanical and electrical strength.

These cutouts are available now in a range of sizes to meet your requirements. See the versatility of this cutout. Ask your nearby Westinghouse representative or distributor for a personal demonstration and Booklets B-3833 and B-4299. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

J-60705

1. PRESTITE PORCELAIN HOUSING—50-ampere, 5-kv, identical for both Type EA and Type HC cutouts.

2. MOLDARTA TYPE EA DOOR—1,200-ampere interrupting capacity.

3. MOLDARTA TYPE HC DOOR—Interchangeable with Type EA cutout door. Interrupting capacity 8,000 amperes at 2,500 volts, 5,000 amperes at 5,000 volts.

Westinghouse

FUSE CUTOUTS

FOR ANY SYSTEM

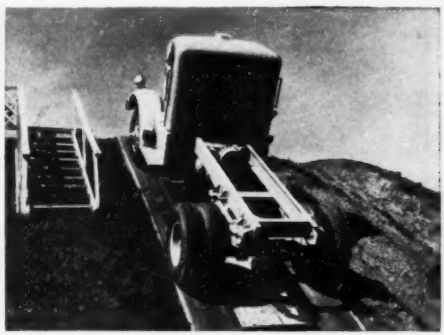
PROOF - *not Guesswork*

Makes FWD America's Foremost Heavy-Duty Truck

Here's actual operating proof by a leading utility. A 45% grade on a road under construction! But that's no problem for this fully equipped FWD Line Construction Truck. It's doing an everyday job. Not much chance for a running start there. But FWDs don't need running starts. With front wheels pulling and back wheels pushing, you climb the steepest hills surely . . . climb them safely. You know you will because FWDs are scientifically tested on FWD's proving ground to climb 70% grades from a standstill! *No wonder over 200 of the nation's top utilities use FWDs — with individual fleets up to 192 units!*

WHAT FWDs DO ON THE PROVING GROUND
1 Highball over hilly curved roads!
2 Slog thru mud — up to the bumper!
3 Speed over 100-ft. unbanked circle!
4 Twist over ditches — 18 inches deep!
5 Drive up 6% grade thru 3-ft. of sand!
6 Climb 70% grade from dead stop!
7 Climb 8-in. beam from standstill!
8 Drill pole holes to prove equipment!
9 Speed safely over level highways!
1
2
3
5
6
7
8
9

This is FWD's proving ground. This is your assurance that the FWD you select has the stamina to insure long life without expensive mechanical breakdowns.



This FWD is climbing a 70% grade on the proving ground. For all the facts about FWD Built-to-Code Units, see your Graybar distributor — or write FWD.

An Invitation To Truck Buyers

We invite you to watch FWDs pass a series of rigid performance tests. Ask your FWD distributor to arrange your visit to our plant. Or — if you can't get away, ask him to show you the movie, *The FWD Story*. In either case, you will see for yourself how FWD trucks can help solve your heavy-duty trucking problems.

Clinton G. Allen
President
The Four Wheel Drive Auto Company

THE FOUR WHEEL DRIVE AUTO COMPANY
Clintonville, Wis. • *Canadian Factory:* Kitchener, Ontario
FOUR AND SIX WHEEL DRIVE TRUCKS

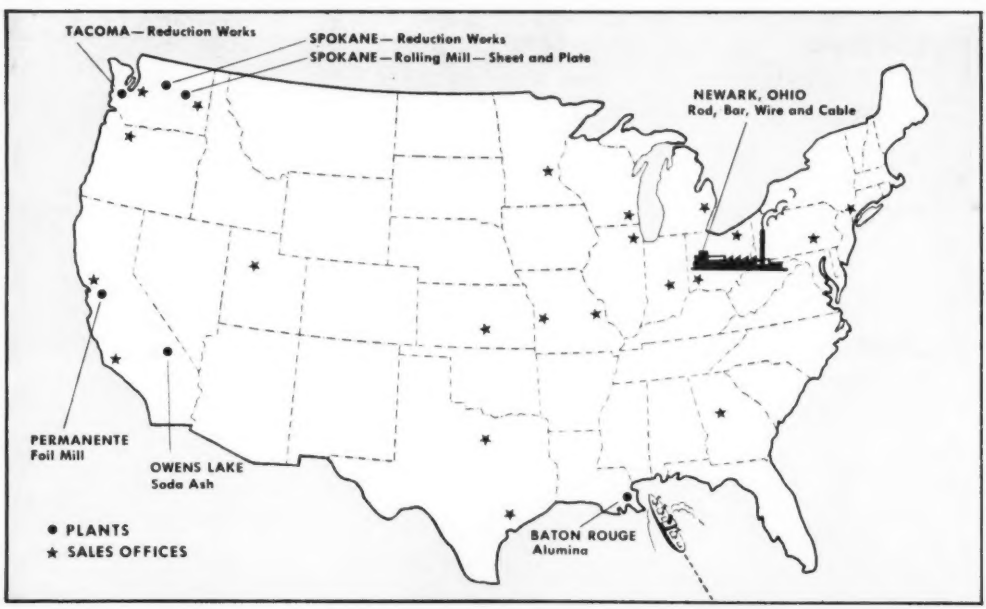
America's Foremost Heavy-Duty Truck

Orders for Kaiser Aluminum Conductor now being confirmed

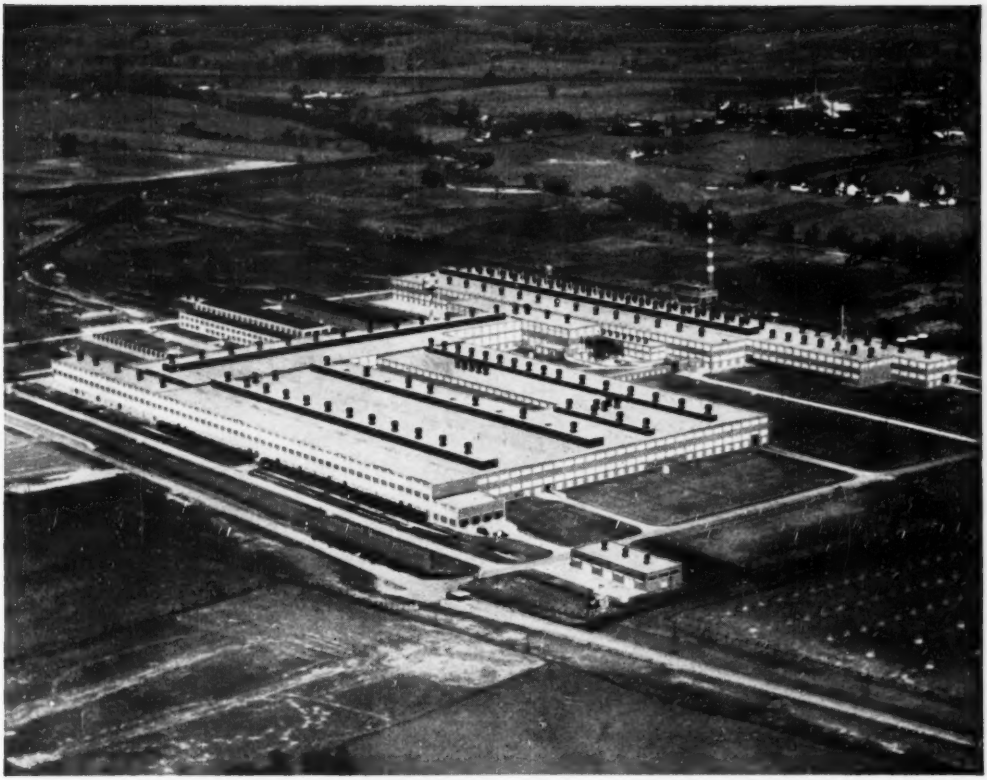
Through its nationwide sales organization and distribution outlets, Permanente Products Company is confirming orders for Kaiser Aluminum Cable and ACSR. Early delivery, according to schedule, is assured.

Two years of intensive engineering and manufacturing preparation has established Permanente Metals as a new, dependable source of aluminum conductor. And installation of new wire and cable production facilities by Permanente Metals makes its Newark, Ohio, plant one of the most modern of its kind in the world. It is being manned by experienced, highly skilled personnel.

When you order Kaiser Aluminum conductor, you'll join thousands of U. S. manufacturers in other fields who look to Kaiser Aluminum for finest quality—and to Permanente Metals for a brand of service that has set high standards for dependability.



Completely integrated production facilities assure you of a dependable supply of Kaiser Aluminum conductor.



Permanente Metals' newest plant is this modern aluminum rod, bar, wire and cable mill at Newark, Ohio.

Sales offices and distributors nearby

Information and service is available from any of Permanente Products' 21 sales offices. If it is more convenient, call the nearest office of General Electric Supply Corporation or Westinghouse Electric Supply Company, national distributors of Kaiser Aluminum conductor.

Kaiser Aluminum Cable is available in a complete range of standard sizes and standard strandings: From 1,590,000 circular mills to No. 6 Awg ACSR and All Aluminum Cable.

Permanente Metals

PRODUCER OF

Kaiser Aluminum Cable

SOLD BY PERMANENTE PRODUCTS COMPANY, KAISER BLDG., OAKLAND 12, CALIFORNIA . . . WITH OFFICES IN:

Atlanta • Chicago • Cincinnati • Cleveland • Dallas • Detroit • Houston • Indianapolis • Kansas City • Los Angeles • Milwaukee
Minneapolis • New York • Oakland • Philadelphia • Portland, Ore. • Salt Lake City • Seattle • Spokane • St. Louis • Wichita

Also available through General Electric Supply Corporation and Westinghouse Electric Supply Company.

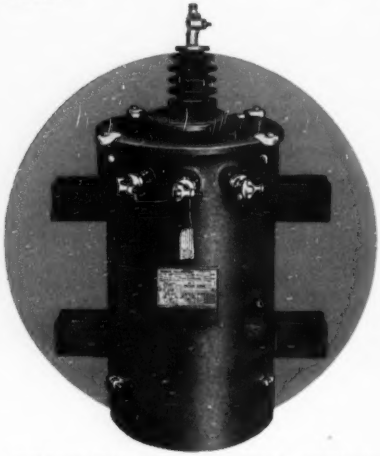
Wagner *Rural Line Transformer* Service

Expert RECONDITIONING GENUINE PARTS

All transformer repair parts are Genuine Wagner Parts and exact duplicates of those in new Wagner Transformers. A few are illustrated and described below.

Wagner Electric Corporation, pioneer builder of transformers, offers a complete line of repair parts and reconditioning service for Wagner Rural Line Transformers — Genuine Repair Parts for "on-the-spot repairs"... or "Factory Reconditioning Service" for transformers that need a complete overhauling... just send them to the nearest Wagner Service Branch.

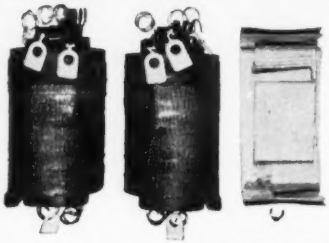
Take advantage of this service — check your Rural Line Transformers and keep them at top efficiency with Wagner Repair Parts and Expert Reconditioning Service.



COMPLETE REBUILDING SERVICE

This service consists of cleaning and painting of transformer, installing all new gaskets, installing new factory-wound coils and insulation and a thorough factory test. A one year warranty against defective material and workmanship applies on all transformer rebuilding jobs. Ship transformer to us prepaid and we will pay return freight charges. Oil, broken or missing bushings, or other major parts are extra. If the transformer does not require complete rebuilding, repairs will be made on a time and material basis.

Wagner Electric Corporation
6456 Plymouth Ave., St. Louis 14, Mo.

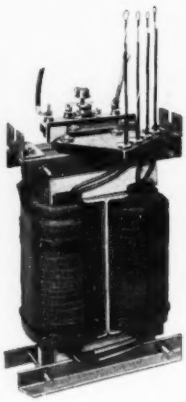


COILS AND INSULATION

A complete set of coils and all necessary insulation for mounting on your own core. A gasket kit is included.

GASKET KIT

A complete set of all composition gaskets used throughout the transformer.



NEW INTERIOR

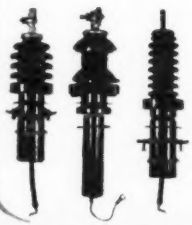
Consists of complete, new core-and-coils assembly with a terminal board or tap changer, with leads ready to install in your tank. A gasket kit is also included.

TRANSFORMER OIL 7N

Genuine Wagner 7N Transformer Oil. Available in 1, 3, 5, 20, 30 and 50 gallon containers.

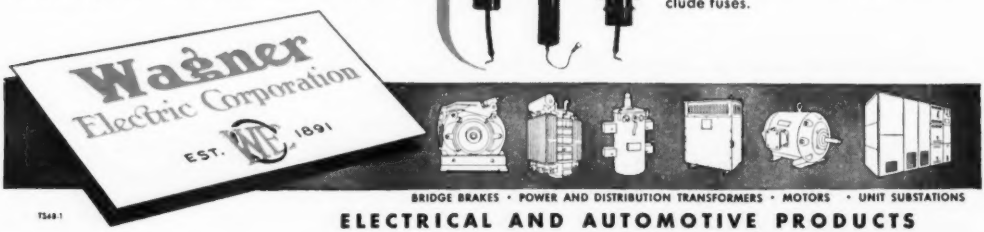
LOW VOLTAGE BUSHING ASSEMBLY

Includes porcelain bushing, composition gasket, solderless connector-type terminal and clamping device.



HIGH VOLTAGE BUSHING ASSEMBLIES

Available in various types to meet a wide range of requirements. They do not include fuses.



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL AND AUTOMOTIVE PRODUCTS

T348-1

Sangamo Watthour Meters

Good for Accuracy . . .

The modern oilless, noiseless, non-corrosive bearing system and rigid dovetailing of elements contribute to *sustained* accuracy. In actual customer service since 1940, a large group of J Meters in an 8-year test showed only five-hundredths of 1% change in accuracy from that at the time of installation!

Good for Revenue . . .

Overload compensation and other inherent overload characteristics will accurately measure *present* and *future* loads up to 400% of meter rating without loss of revenue.

Good for Economy . . .

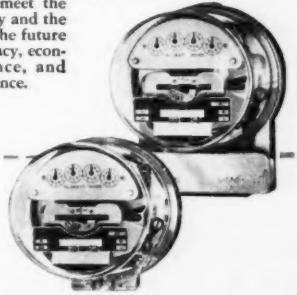
J Meters are built of corrosion-resistant materials and have full temperature compensation for cost-saving outdoor installations. All parts are easily accessible for inexpensive calibration, inspection, and replacements.

Good for Troublefree Service . . .

Sangamo J Meters have unusual freedom from electrical failure due to high insulation levels. Troublefree operation is inherent in the oilless bearing system. Millions of J Meters in use since 1940 have proved this fact.

* * *

Sangamo J Meters have *proved*, by years of service, their ability to meet the requirements of today and the anticipated loads of the future with sustained accuracy, economy of maintenance, and troublefree performance.

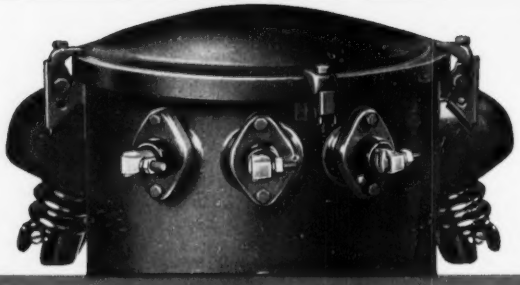


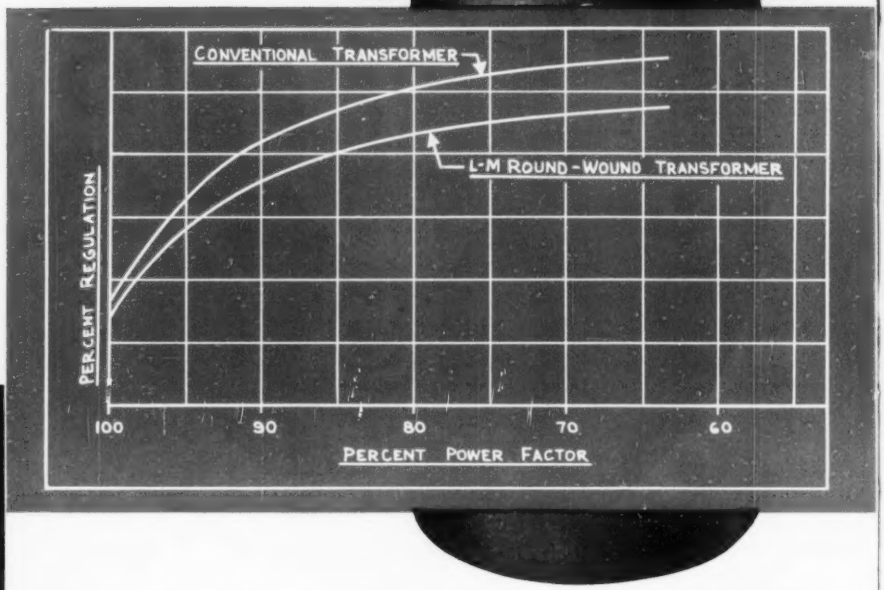
50TH ANNIVERSARY SANGAMO 1899 - 1949

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

EM493

"Better regulation at all power factors..."



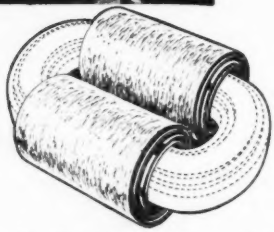


ROUND WOUND

a major advantage of L-M ROUND-WOUND transformers," says ENGINEER THOMPSON

"There's no patent on designing good regulation into a transformer," says Mr. Thompson. "The problem is to get good regulation *without* sacrificing other desirable characteristics, *and* without increased cost to the user.

"We are able to solve the problem with our wound core which is not cut, unwound or disturbed in any way after annealing, resulting in uniformly stable core loss and low exciting current. The compact cruciform cross section shape of the Round-Wound core enables the designer to use long round coils with fewer turns and smaller mean turn diameter, thus gaining lower resistance and reactance values. Uniformly low impedance with improved regulation at all power factors—both recognized features of real significance under today's operating conditions—are outstanding features of the Round-Wound transformer."



Continuous wound core, which is never cut, unwound, or disturbed in any way after annealing, because the long round coils are wound directly onto the core by L-M's ingenious Round-Wound method.

Want to know more about the savings "Round-Wounds" offer the utility company? Want to know more about how L-M Round-Wound transformers are designed, why they give "Balanced Performance" and operating benefits to the user, better service to the customer? Ask the L-M Field Engineer for this fact-packed bulletin No. 16-G-1, or **write Transformer Division, Line Material Co., Zanesville, Ohio.**

LINE MATERIAL Transformers

Complete Coordinated Equipment For All Distribution Requirements

LM

L-M "Round-Wounds"

just don't leak!

. . . we've been using this "upside down" test to check transformer cover sealing since 1936

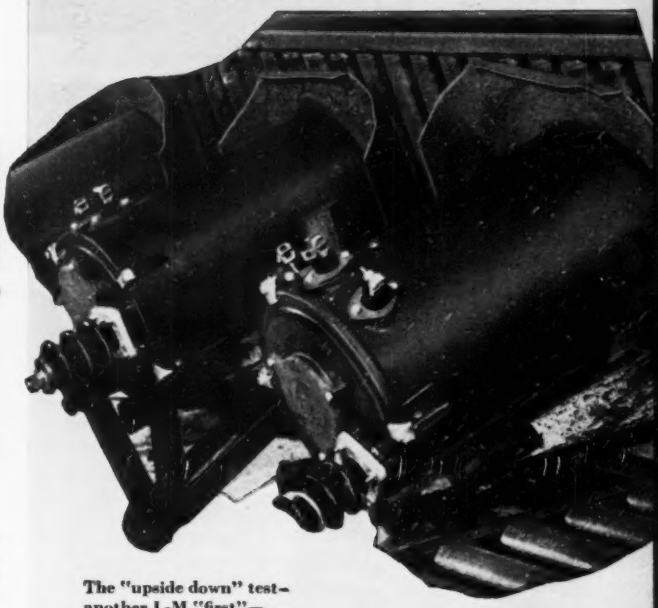
Recently there's been a good deal of interest in transformer tank sealing, with sealed tank construction incorporated in the Fourth Report of the EEI-NEMA Joint Committee on Transformer Standards.

But tank sealing is an old story to Line Material. Years ago new customers were surprised because *we* shipped our transformers with the oil *inside*—not in a separate drum as others did. But our customers soon learned that the oil didn't leak out of L-M transformers because of L-M's original oil-tight tank and bushing seals.

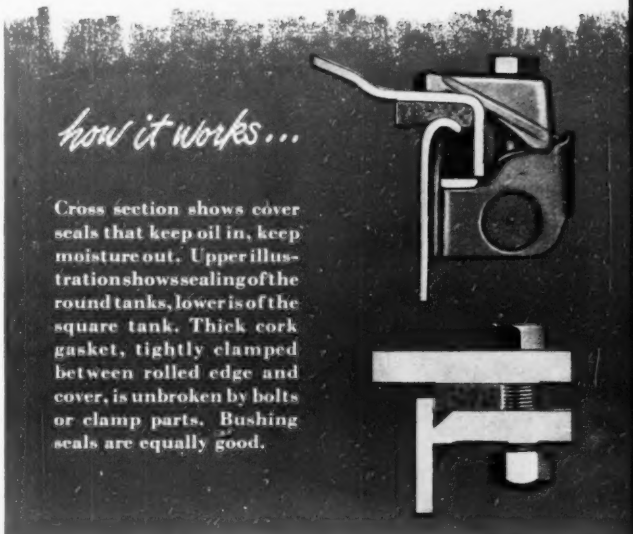
Today L-M is recognized as one of the largest manufacturers of distribution transformers. L-M is also known as a leader in the development of *sealed tank* distribution transformers.

But it's not only the fact that the tanks on L-M "Round-Wounds" are sealed that's important. It's also *what* is sealed into the tanks that counts. In the L-M Round-Wound Transformer is the famous wound core that isn't cut, unwound, or disturbed in any way after annealing. There are the long, round coils wound directly onto the core. The design provides "Balanced Performance" with its many desirable characteristics—high short time overload capacity, excellent regulation, many other features.

You get more with "Round-Wounds." Why not get more information about them? Ask the L-M Field Engineer for the story—or write—**Transformer Division, Line Material Company, Zanesville, Ohio.**



The "upside down" test—another L-M "first"—long ago!



Cross section shows cover seals that keep oil in, keep moisture out. Upper illustration shows sealing of the round tanks, lower is of the square tank. Thick cork gasket, tightly clamped between rolled edge and cover, is unbroken by bolts or clamp parts. Bushing seals are equally good.

LINE MATERIAL Transformers

Complete Coordinated Equipment for All Distribution Requirements

throw away
your paint brush

get ELEMEX capacitors in Stainless Steel tanks

. . . with L-M "Lifetime" solder-sealed bushings

. . . in 15 and 25 kvar sizes in standard voltage ratings

. . . at NO increase in price

One utility company estimates that it costs $8 per unit to repaint capacitors. *Whatever* it costs is *too much*—when you can get *good* capacitors like ELEMEX in *stainless steel tanks!* And that's not even considering all their other advantages. They're pretty swell jobs; we think it would be worth your time to take a good look at them!

Stainless steel tanks mean no painting, ever! They also mean that the lineman doesn't have to take time to scrape paint to get a good ground. Tanks are "Hydis" treated—for good heat dissipation.

OTHER ELEMEX ADVANTAGES

Uniform terminal elevation—another time-saving feature. The 15's and the 25's have the same terminal elevation above the hanger in each voltage class. No change in leads when you replace or mix 15 *kvar's* with 25's. The 25's are 5¼" longer *below* the hanger, so they're easy to identify from the ground. All sizes same width and thickness, fit same hanger bolts.

"Paragroove" Connectors, another L-M "first": wire is just dropped in and clamped; no crossing of leads, no loose parts. **L-M "Lifetime"** solder-sealed bushings keep air out, keep ELEMEX liquid in—permanently.

Low unit stress: conservative design assures long life. **Safer:** discharge resistors across every pack or parallel group of packs. **Individual Testing** of packs, tanks and completed capacitor before, during, and after impregnation assures uniformity, long life.

Continuous individual evacuation, drying, and capillary impregnation with ELEMEX non-inflammable dielectric assure precise control of power factor and capacitance—an exclusive L-M research development.

ELEMEX capacitors have an outstanding 5-year service record . . . negligible rate of failure . . . *not one* leaky bushing . . . and thanks to the L-M braced sealed carton, only one has broken in shipment! A good record, don't you think?

WANT MORE INFORMATION?

Want details on ELEMEX? Data on capacitor application, uses, savings, power factor calculation? L-M's engineering staff will be glad to help you. **Ask the L-M Field Engineer** to get you the information you need, ***or write*** **Line Material Co., Milwaukee 1, Wisconsin.** 6983

LINE MATERIAL Capacitors

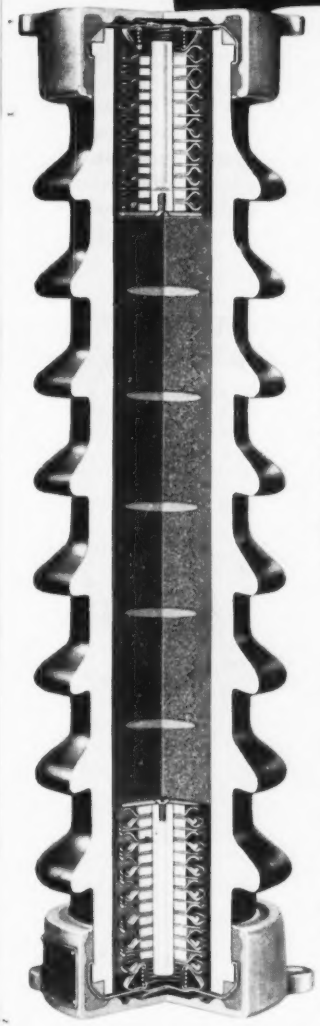
LM

Complete Coordinated Equipment for All Distribution Requirements

Here's Dependable, Economical Protection

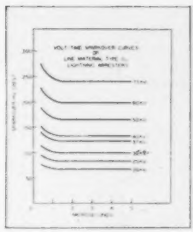
IN A 20 TO 73 KV "LINE TYPE" ARRESTER FOR SMALL AND MEDIUM-SIZE SUBSTATIONS . . .

L-M type DL Lightning Arrester



You don't have to invest a small fortune in equipment to protect small and medium-size power transformers. The type DL arrester gives you a safe margin of dependable protection. Its sparkover is low; it has ample discharge capacity to handle all kinds of lightning surges without damage; low IR drop but high resistance to follow current; extremely long life with unchanging characteristics; the arrester is almost completely free from outside influences; and the cost leaves your equipment budget feeling no pain.

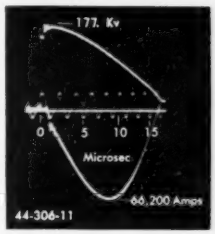
Consistently Low Impulse Sparkover



As the front ends of the time-current curves show, the sparkover is consistently low, even under steep-front waves. Yet it's plenty high to prevent operation during switching surges.

Extremely High Discharge Capacity

Oscillogram shows NEMA standard 65,000 amp test on a 5 x 10 ms surge. The DL has plenty of discharge capacity, because the L-M "Granulon" is molded right *into* the housing, filling it completely from wall to wall. Thus the element has greater diameter and correspondingly higher thermal capacity. Housing and gap are permanently sealed at top and bottom with heavy synthetic gaskets compressed under spun-on copper caps, plus heavy galvanized malleable caps cemented on to protect copper caps and seals and provide for connections and mounting.



Heavy Duty Stabilized Spark Gap

Heavy alloy discs are separated by ceramic spacers with silvered surfaces which form a voltage divider of the capacitance type. The material used has a dielectric constant many times that of usual ceramic insulators, assuring a high degree of stability and freedom from outside influences.

It's a *heavy duty* gap—two ways. *Electrically*, because it has ample capacity to handle both heavy and long low surges without damage or change in the low sparkover. *Mechanically*, because we put half of the gap at each end of the arrester so there's very little chance of damage in shipping and handling.

Wide Variety of Mountings

Five different brackets or hangers are available for convenience in hanging the arrester from substation structures or mounting on walls or single or double crossarms.

Here's Complete Information

Details on design, construction, sizes, ratings, dimensions. Better get a copy of this new bulletin LA-1. Ask the L-M Field Engineer or write Line Material Co., Milwaukee 1, Wis.

LINE MATERIAL Lightning Arresters

Complete Coordinated Equipment for All Distribution Requirements

KYLE automatic oil circuit RECLOSERS for precise coordination . . .

Kyle reclosers offer complete protection for lines, and safety for linemen. They are the original, and still the best, automatic protection for both single and three-phase lines. They offer flexibility to meet all conditions, and precise coordination with fuses, sectionalizers, other reclosers, and station breakers. They avoid lockouts and outages, cut maintenance, and protect your equipment and service.

Outstanding Kyle Recloser Features

Three reclosures before locking out; choice of four opening sequences . . . Coils and sequences easily changed in the field . . . Trip-free operating handle. Tank and cover are dead; bushing terminals are the only live parts . . . Positive dependable operation—no motors or clockwork . . . Large cast aluminum cover; sleet hood protects operating handle and counter . . . Ratings 5 to 50 amps.; 2400 to 15,000 volts; minimum tripping current 10 to 100 amps.; interrupting capacity 150 to 1200 amps.

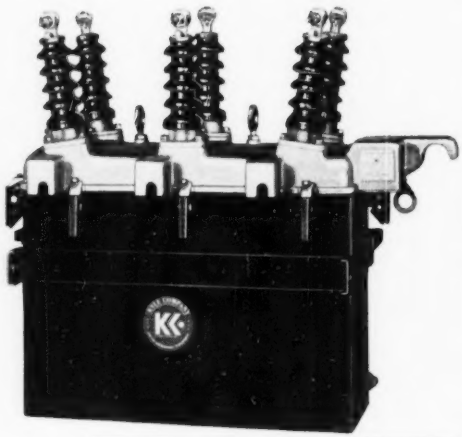
. . . ON SINGLE-PHASE . . . AND THREE-PHASE LINES

KYLE
TYPE H
Single-phase recloser

Protects feeders and branch lines on both single- and three-phase systems by coordinating with fuse links, sectionalizers, and other reclosers. Isolates permanent faults to small parts of a system and thus cuts amount of patrolling required.

KYLE
TYPE 3H
Three-phase recloser

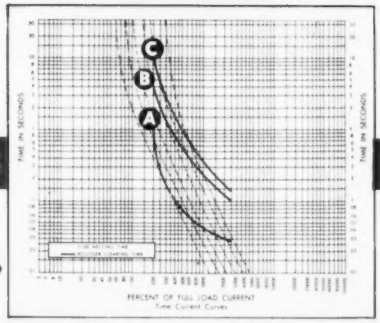
A practical combination of single-pole units so as to permit single-phase operation of any of the three-phase units so long as no lockout is required. If any one unit locks out, the other two lock out simultaneously. Prevents "single phasing" and overloading and burning out 3-phase motors. 7119



CHOICE OF 4 OPENING SEQUENCES

Curves show recloser action on each sequence:

1. Curve A—four fast openings.
2. Curve A and B—two fast, two retarded openings.
3. Curve C—four extra retarded.
4. Curve A and C—two fast and two extra retarded.



LM KK

For complete information ask the L-M Field Engineer or write **KYLE COMPANY** division of Line Material Company Box 2077, Milwaukee 1, Wisconsin

LINE MATERIAL Kyle Reclosers

7119

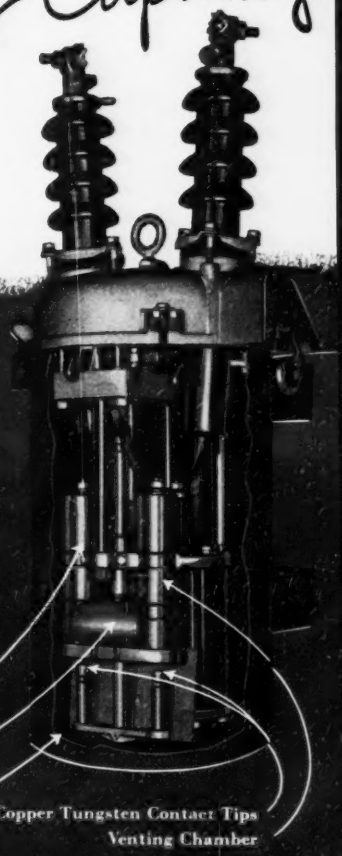
Complete Coordinated Equipment for All Distribution Requirements

UP TO

4,000 Amps. Interrupting Capacity

IN THE NEW TYPE "L"

KYLE OIL CIRCUIT RECLOSER



Now you have Kyle recloser protection with all the outstanding Kyle recloser features, for lines with loads up to 100 amps and fault currents as high as 4000 amperes. These heavy fault currents can be handled successfully because of the new *oil cross blast* method of arc extinction.

SPECIAL FEATURES

This new type L recloser offers:

Operating voltages, phase to phase, 2.4 to 15 kv

Ratings: 25, 35, 50, 70, and 100 amperes, for minimum **tripping currents** of 50, 70, 100, 140, and 200 amps, respectively. Coils are interchangeable in the field

Precise coordination with line or back-up fuses, sectionalizers, other reclosers, and breakers

Insulation level meets A.S.A. standards for 15 kv power circuit breakers. **Impulse** level 110 kv

Control mechanism fully hydraulic, virtually free from variations caused by oil temperature viscosity changes; rugged, shock-proof; trouble-free. Trip-free operating handle; many other safety features

Size approximately 37" high, tank 11" diameter. Large sleet hood protects operating handle and counter; may be rotated in 90 degree steps

Weight with oil, 170 pounds

Greater Accuracy: Wider Choice of Operating Sequences

Three reclosures before locking out. **Standard sequence** is two fast operations, two retarded (two curves A, two curves B in chart).

Optional Sequences, easily changed in the field: four fast operations (four curves A); *or* two fast and two extra-retarded (two curves A, two curves C).

Other sequences available from the factory.

Kyle Company
division of Line Material Co.

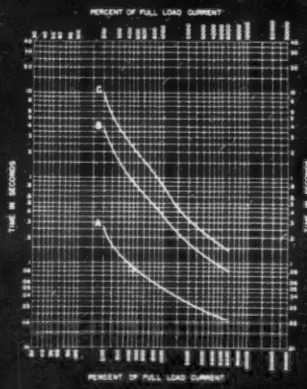
New oil cross blast arc extinction!

Provides minimum arcing time and freedom from restrikes at all current values and power factors within the recloser rating. Arcs are drawn in series. Arc in the pressure chamber forms gas which blasts oil into the venting chamber, extinguishing the arc.

Time Current Curves!

Read all about it!

Get the whole story, in this easy-to-read illustrated bulletin. Ask the L-M Field Engineer for a copy or write Line Material Co., Kyle Company division, Box 2077, Milwaukee 1, Wisconsin.



LINE MATERIAL KYLE RECLOSERS

KY LM

Complete Coordinated Equipment for All Dis

KYLE

TYPE GS AUTOMATIC OIL SECTIONALIZER

HAS ALL THE **KYLE** SAFETY FEATURES

1
Tank, cover, and operating handle are dead. Tank may be grounded.

2
Mechanism cooled, and insulated from tank, by transformer oil.

3
Standard cover type bushings. Terminals are the only hot spots.

4
Trip-free operating handle.

RATINGS:

Seven sizes, with minimum tripping current 8 to 100 amps to coordinate with reclosers rated from 3 to 50 amps; maximum operating current 150 to 1200 amps; 2400 to 15,000 volts. Ratings may be changed by changing coils in the field. Weight with oil about 20 pounds. Crossarm or direct pole mounting hangers.

Isolates permanent faults on branch lines of recloser-protected systems

Kyle automatic oil sectionalizers provide dependable automatic protection against permanent faults on branch lines. They do not open on temporary faults, but operate to disconnect the branch only after one, two, or three operations of the back-up recloser have failed to clear the fault. After the third recloser operation, the contacts of the sectionalizer open up while the recloser is open. Thus the faulted branch is disconnected, and the recloser resets itself and maintains service on the rest of the system.

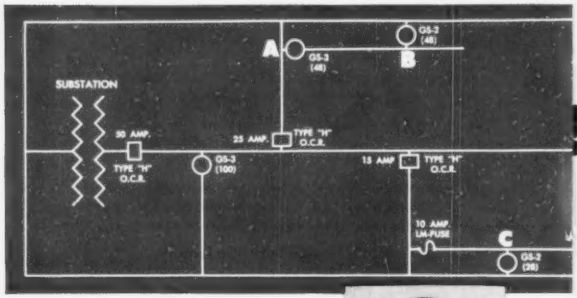
The sectionalizer may be set to open on a permanent fault after one, two, or three operations of the recloser, as desired. Since the sectionalizer does not interrupt short circuit currents, contacts last indefinitely, and there is no carbonization of the oil.

Get the whole story !

For details, dimensions, ratings, mountings, and a complete description of how Kyle type GS sectionalizers operate, ask the L-M Field Engineer for a copy of this Bulletin CR3, or write Kyle Company division of Line Material Co., Box 2077, Milwaukee 1, Wisconsin.

To Protect Your Lines with Kyle Type GS Sectionalizers

The diagram shows how it is done: *Point A* shows a sectionalizer set to open on the third recloser operation, indicated by GS-3. *Point B*: further sectionalizing by setting the sectionalizer to open on the second operation of recloser—indicated by GS-2. *Result:* a permanent fault beyond *B* causes sectionalizer GS-2 to lock out after second recloser operation; service is maintained on the branch protected by sectionalizer GS-3 at *A*. *Point C*: Sectionalizer GS-2 set to open on second recloser operation isolates a permanent fault before the back-up fuses are damaged or blown by the third operation of the recloser. Kyle Sectionalizers also will replace branch line fuses on systems protected by Kyle Type H Reclosers, giving you complete automatic protection.



KYLE COMPANY

division of Line Material Company, Box 2077, Milwaukee 1, Wisconsin

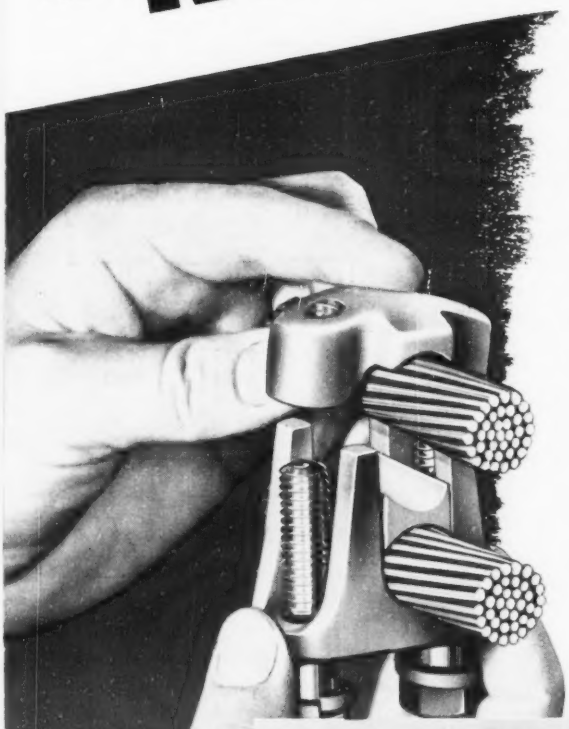
7120

LINE MATERIAL Kyle Sectionalizers

Complete Coordinated Equipment for All Distribution Requirements

IT TAKES LESS THAN
half the torque
TO TIGHTEN THIS

new KYLE type HD two-bolt HEAVY DUTY CONNECTOR



Here's an ideal connector for heavy stranded wire from 4/0 to 1000 MCM. It's easy on cable; gives a firm, low-resistance connection that stays cool; bolts won't drop out; it's easy to tighten, and it just won't come loose!

The tightening force is applied by two bolts which accommodate the standard lineman's wrench instead of the large wrench required for split bolt connectors of the same size. As the table below shows, tightening torque required is quite low—which linemen will like—and which, along with the copper spacer bar, prevents crushing and distortion of strands.

and it stays tight!

A unique feature is that, as bolts are tightened, the tension causes a slight deformation in the bronze cap which locks the bolts tightly in place. Vibration won't—can't—loosen them! Yet the cap springs back to its original shape when the bolts are loosened, so this locking action does not affect the re-use of the connector.

See how easy it is to tighten Kyle "HD's"!

SIZES Stranded Wire	TIGHTENING TORQUE	
	Per bolt, for type HD connectors	NEMA standards for split bolt connectors
4/0	240 inch-pounds	750 inch-pounds
350 MCM	300	800
500 MCM	360	850
750 MCM	540	1200
1000 MCM	600	1400

Picture shows the 350 MCM size of the new Kyle HD Connector. Body and cap are red brass; spacer bar is copper; and bolts are silicon bronze. Also furnished zinc-plated for conductors other than copper. The connector is designed so as to give a tight, low resistance connection without distortion of the strands. Nicely rounded body makes it easy to do a good tape job. It's easy to tighten, and has many other advantages over split bolt connectors—yet it costs even less. It's a good job—and a good buy for you! Try it!

For samples and prices ask the L-M Field Engineer, or wire or write

KYLE COMPANY division of Line Material Company
Box 2077, Milwaukee 1, Wisconsin

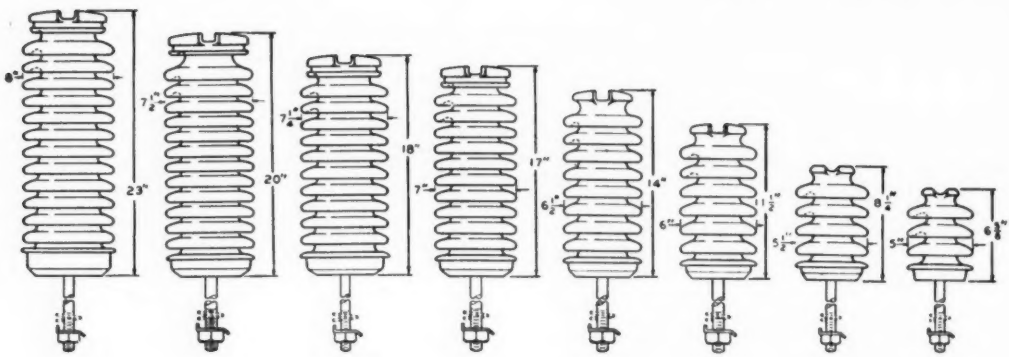
7122

KC LM

LINE MATERIAL Kyle Connectors

Complete Coordinated Equipment For All Distribution Requirements

the



9982 9978	9366 9466	13560 13561	9355 9455	9345 9445	9335 9435	9325 9425	9320 9420

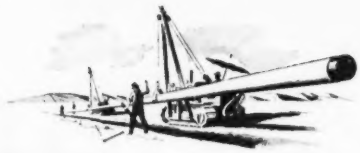
CATALOG NO. SHORT STUD UNITS.....	9982	9366	13560	9355	9345	9335	9325	9320
CATALOG NO. LONG STUD UNITS.....	9978	9466	13561	9455	9445	9435	9425	9420
Recommended Line Voltages, kv.....	88	66	60	55	45	35	25	20
Striking Distance, inches	19.25	17.25	16	14.5	12.25	9.5	6.5	5
Dry Flashover Voltage	200000	175000	160000	150000	125000	110000	80000	70000
Wet Flashover Voltage	170000	150000	135000	125000	100000	85000	60000	50000
Impulse Flashover Voltage, Pos. 1.5 x 40.....	330000	290000	275000	255000	210000	180000	130000	100000
Impulse Flashover Voltage, Neg. 1.5 x 40.....	425000	380000	365000	340000	260000	205000	155000	125000
Leakage Distance, inches	53	45	42	40	29	22	14	10
Mechanical Strength, lbs.	2800	2800	2800	2800	2800	2800	2800	2800

Lapp LINE POST

...The high-voltage insulator that offers an *Extra* margin of operating security... electrically and mechanically

No insulator ever had a more severe baptism-under-fire, nor a better chance to prove its merits, than the Lapp Line Posts. Introduced as a unit which would stand up where conventional insulators fail, its record of operating security has been largely built on installations in trouble spots. Our earliest posts now have 18 years of service behind them; there can no longer be a question about the superiority of Line Post design—in eliminating puncture and cracking, in better performance under dirt conditions and power arcover, in ability to withstand mechanical attack. Most power companies that have tried Lapp Line Posts have standardized on Lapp Line Posts. There's a detailed discussion of the Line Post design, as well as complete specifications, in the new Lapp Catalog No. Seven. If you haven't received your copy, we'll send it on request. Lapp Insulator Co., Inc., LeRoy, N.Y.

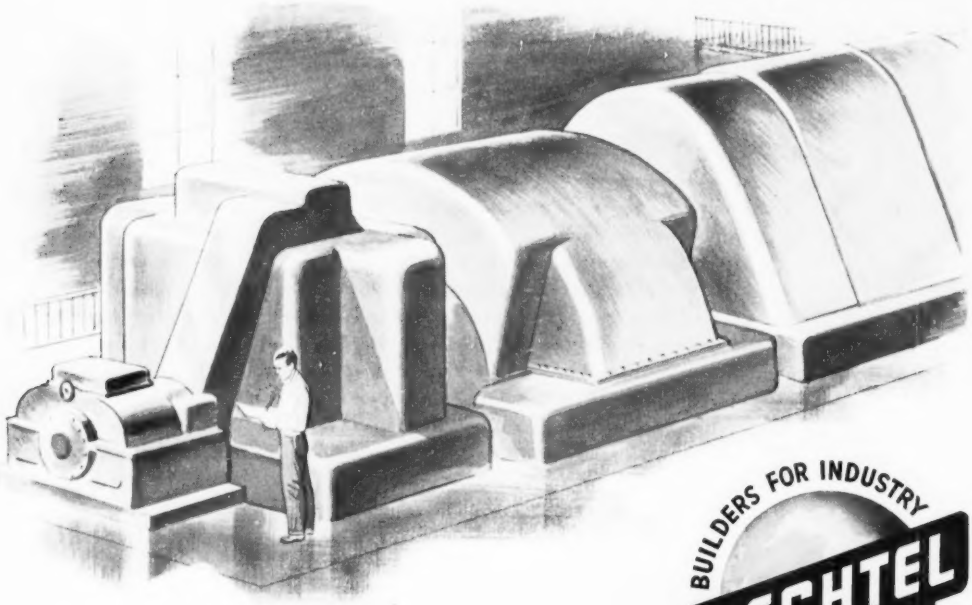
Lapp INSULATORS



Oil...Gas...Water...
ELECTRIC POWER

Like a baseball game—this big league contest between Power Needs and Power Supply. Mountain water is pitching great ball, keeping the Pelton wheels swinging. And getting tight support from oil and gas on a triple play—fuel to steam to electric power.

Credit Bechtel Corporation with some important "assists"—new hydro-electric plants, new pipe lines and refineries to increase the supply of fuel, new steam generating stations and electrical distribution systems. Engineering and construction play every position.



BUILDERS FOR INDUSTRY

BECHTEL

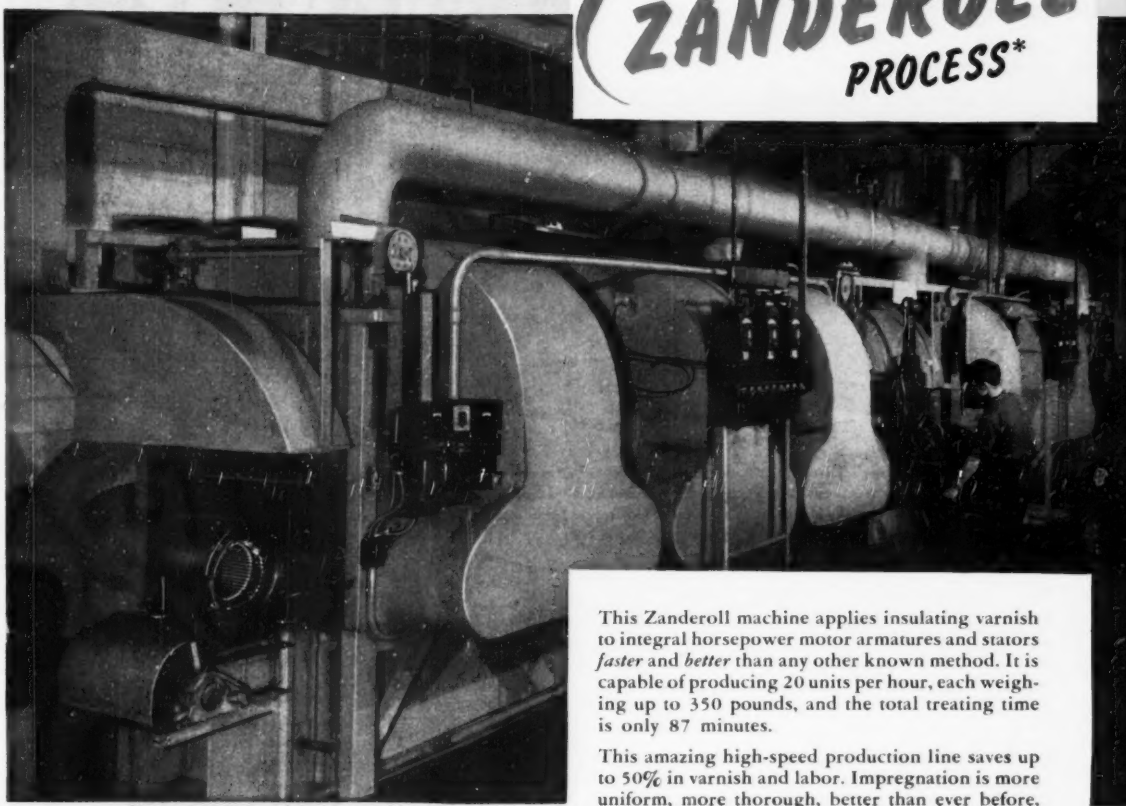
BECHTEL CORPORATION

LOS ANGELES • **SAN FRANCISCO** • NEW YORK

ECONOMIC STUDIES • PROCESS DESIGN
ENGINEERING
PURCHASING • CONSTRUCTION

INTEGRAL HORSEPOWER MOTORS

MADE FASTER MADE BETTER WITH THE ZANDEROLL PROCESS*



*Patented in U. S. and foreign countries by the Sterling Varnish Company, Haysville, Pa.

This Zanderoll machine applies insulating varnish to integral horsepower motor armatures and stators *faster* and *better* than any other known method. It is capable of producing 20 units per hour, each weighing up to 350 pounds, and the total treating time is only 87 minutes.

This amazing high-speed production line saves up to 50% in varnish and labor. Impregnation is more uniform, more thorough, better than ever before, and Zanderoll changes the old messy varnishing job to a clean, modern method of application with fire hazard reduced to an absolute minimum.

There is a Zanderoll machine available for the production of any type motor—integral horsepower, fractional horsepower or large motors of any size. Write for more details as applied to your particular production conditions, or better yet, call in one of our engineers to analyze your situation for economies and improvements.

POWER PIPING DIVISION
BLAW-KNOX CONSTRUCTION COMPANY
1525 Pennsylvania Ave., N.S. Pittsburgh, Pennsylvania

Your Copy is FREE

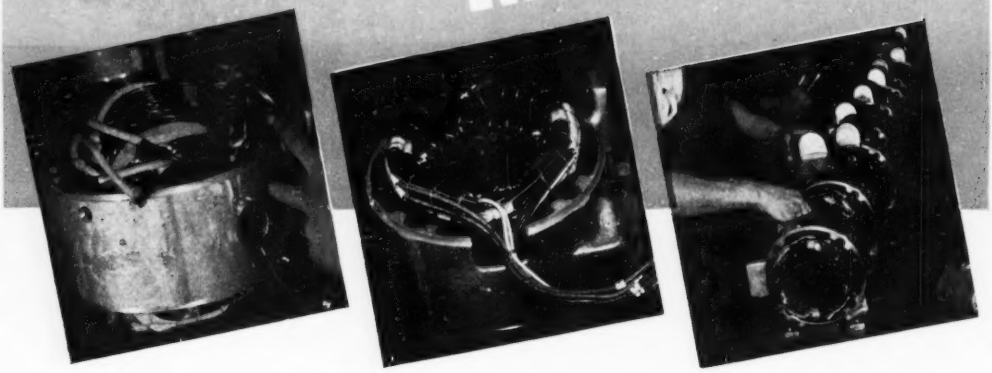
BULLETIN 2263 TELLS ALL—WRITE FOR IT TODAY!

POWER PIPING DIVISION

OF BLAW-KNOX CONSTRUCTION COMPANY · PITTSBURGH, PA.

American MOTOR LEADS

are insulated and protected *with* NATVAR 400



The compact 1 HP single phase 115/230 volt, capacitor start—induction run motor, manufactured by American Electric Motors, Inc., Los Angeles, is especially recommended for use around dirt or dust-filled machines such as table saws or other woodworking tools. The centrifugal starting switch is totally enclosed, and the solid welded copper bar armature is mounted on high quality, standard size ball bearings, lubricated for life. Leads are insulated and protected with Natvar 400.

American Electric Motors, Inc., Los Angeles, manufactures a line of induction motors, both single phase and polyphase, and a line of grinders and buffers. An excellent indication of their performance and value is the fact that they are widely distributed by a principal mail order chain.

Natvar 400 Extruded Vinyl Tubing is used on motor leads, because it is approved for 105°C continuous operating temperatures, it simplifies assembly, and gives better all around insulation and protection with considerable savings in labor and material costs and reduced waste.

Natvar 400, in addition to its ability to withstand heat, also has uniformly superior resistance to oil. It is available for prompt delivery either from a nearby wholesaler's stock or direct from our own. Full Underwriters' Laboratories report on request.

Natvar Products

- Varnished cambric—straight cut and bias
- Varnished cable tape
- Varnished canvas
- Varnished duck
- Varnished silk
- Varnished special rayon
- Varnished Fiberglas cloth
- Silicone coated Fiberglas
- Varnished papers
- Slot insulation
- Varnished tubings and sleevings
- Varnished identification markers
- Lacquered tubings and sleevings
- Extruded vinyl tubing and tape
- Extruded vinyl identification markers

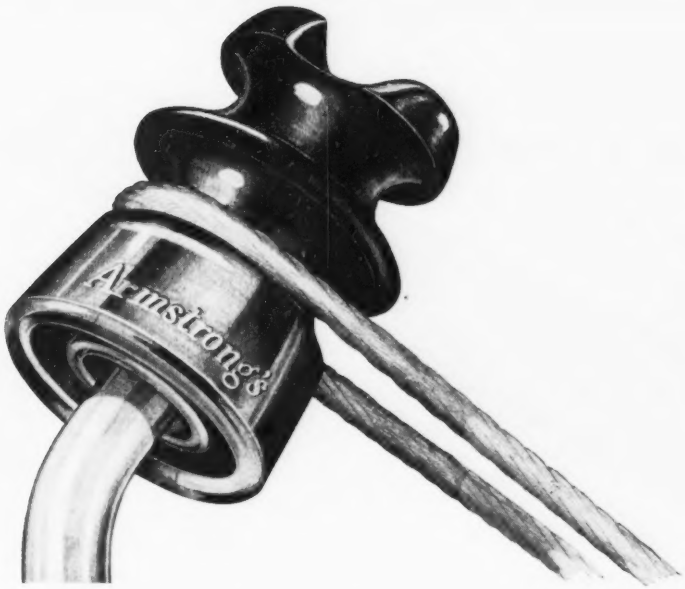
Ask for Catalog No. 21

THE NATIONAL VARNISHED PRODUCTS Corporation

TELEPHONE
RAHWAY 7-2171

CABLE ADDRESS
NATVAR: RAHWAY, N. J.

221 RANDOLPH AVENUE ★ WOODBRIDGE NEW JERSEY

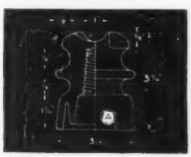


Today's glass insulator has strength to spare

Armstrong's Glass Insulators meet or exceed specifications

Catalogue No. 51-2U
Made in Brown and Clear Glass

Edison Electric Institute Class. 2
*Dry 60 Cycle Flash-over—Volts 59,000
*Wet 60 Cycle Flash-over—Volts 23,000
Approx. Mechanical Strength, Lbs. 2,500

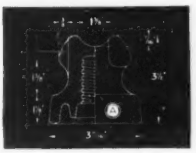


Catalogue No. 51-C1
Made in Brown and Clear Glass

Edison Electric Institute Class. 1
*Dry Flash-over—Volts.. 43,300
*Wet Flash-over—Volts. 23,500
Average Mechanical Strength, Lbs. 3,400

Catalogue No. 51-1A
Made in Brown and Clear Glass

Edison Electric Institute Class. 1A
*Dry Flash-over—Volts.. 59,000
*Wet Flash-over—Volts. 26,000
Average Mechanical Strength, Lbs. 2,500



*Test by Electrical Testing Lab., New York

Armstrong's Insulators are stronger than supporting pins

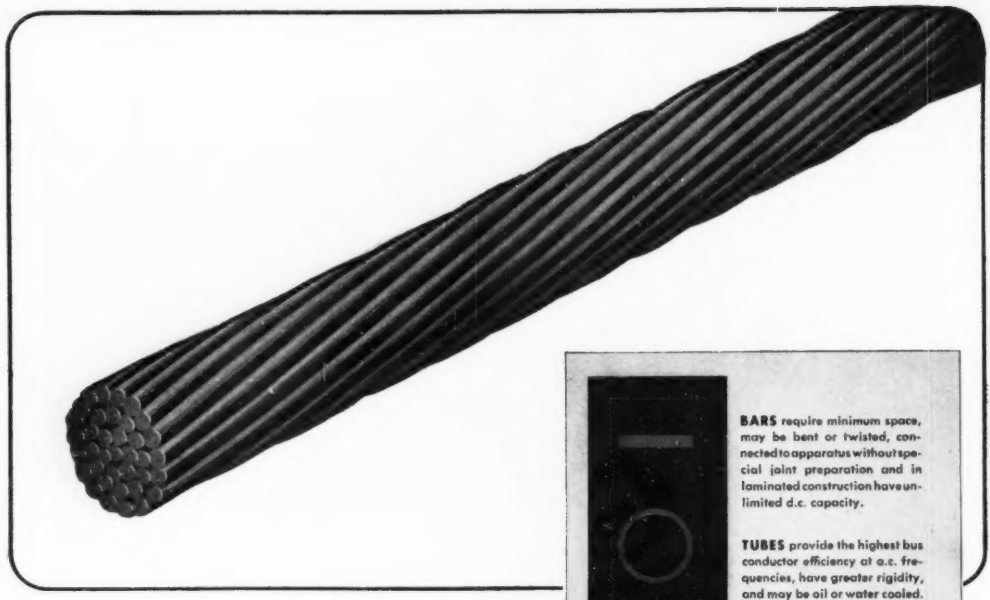
The modern industrial glass in Armstrong's low and medium voltage insulators has added strength to resist severe field conditions. In actual tests, Armstrong's Glass Insulators withstand loads that bend standard metal pins. That's why you can rely upon them to give dependable, trouble-free service.

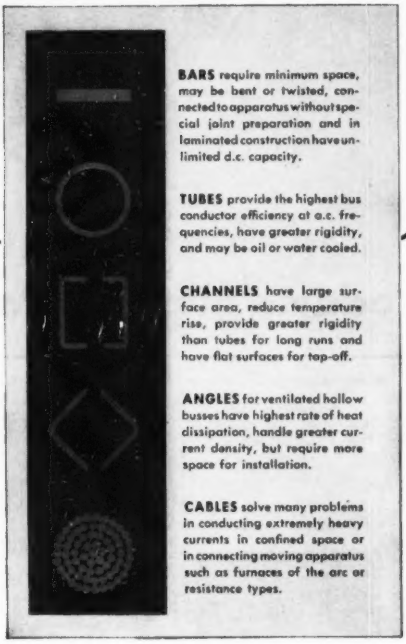
Because Armstrong's Glass Insulators are mass-produced on completely automatic machines, they reduce costs as much as 40%. Yet custom controls insure uniformly high quality. Each production run is tested for resistance to thermal shock. Each pin cavity is hand gauged for diameter and thread contour. Hence, Armstrong's Glass Insulators always meet or exceed E.E.I., A.S.T.M., and A.S.A. specifications.

Try a test installation of Armstrong's Glass Insulators on your own lines. They're a safe way to combat increasing line construction costs. Call your distributor for samples and prices. Or write to Armstrong Cork Co., Industrial Division, Millville, New Jersey. These glass insulators are available for export.

ARMSTRONG'S GLASS INSULATORS

do the job for 40% less





BARS require minimum space, may be bent or twisted, connected to apparatus without special joint preparation and in laminated construction have unlimited d.c. capacity.

TUBES provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

CHANNELS have large surface area, reduce temperature rise, provide greater rigidity than tubes for long runs and have flat surfaces for tap-off.

ANGLES for ventilated hollow busses have highest rate of heat dissipation, handle greater current density, but require more space for installation.

CABLES solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as furnaces of the arc or resistance types.

Copper Cables

. . . for heavy currents and flexibility in confined space

A BUS of cable connections is sometimes more convenient than the more rigid conductor shapes. One example is where extremely heavy currents are required in a confined area.

Flexibility is another advantage offered by cable conductors. They are used for this reason in connecting the main bus run to the electrodes of arc furnaces and resistance furnaces of high capacity.

Anaconda Bus Conductors are made in this and the four other standard shapes illustrated. Each is produced in a wide range of capacities, and all are made of *copper* . . . the bus conductor material that combines low electrical resistance, high thermal conductivity and high corrosion resistance with adequate strength. For detailed information, write for Anaconda Publication C-25.

47190

ANACONDA

Anaconda

BUS CONDUCTORS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

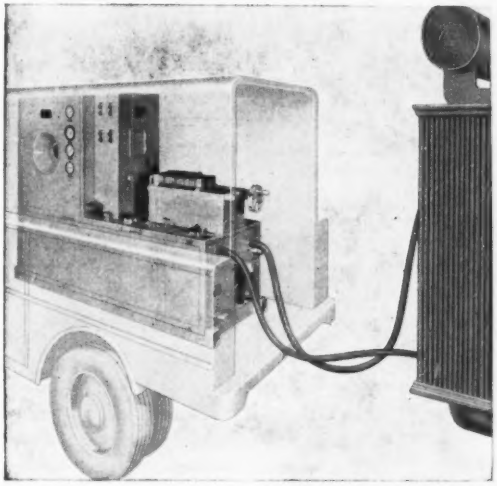
Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

BOWSER
ESTABLISHED 1885

OIL RECONDITIONING UNITS

. . . . for Transformers and Circuit Breakers



BOWSER HYDRO-VOLIFIER RESTORES OIL DIELECTRIC TO 35 K. V

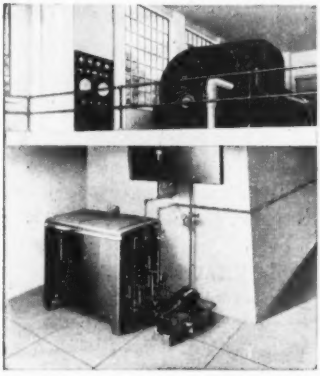
. . . in a *single pass!* It removes volatile corrosive acids, gases, dissolved moisture and solids—the enemies which promote sludge formation in insulating oils. Some users say that Hydro-Volified oil surpasses original insulating oil values and has greater stability.

NO SERVICE INTERRUPTIONS

This self-contained, exclusive Bowser process reconditions transformer oils WHILE ENERGIZED! Fewer "spare" transformers are needed—operating efficiencies are higher. One man with a truck-mounted Hydro-Volifier can efficiently serve widespread substation systems.

Capacities 100-300-500 GPH.

. . . . for Turbines to 110,000 K. W.



BOWSER TURBINE OIL RECONDITIONER DOES NOT DISTURB INHIBITORS

"Bone dry," crystal-clear oil from a Bowser oil reconditioner is the best stay-on-the-job insurance any turbine bearing can have. Inhibitors are not disturbed and there are no moving parts.

The process effectively removes deteriorating elements with . . .

- No Aeration
- No Turbulence
- No Heat
- No Catalysis
- No Water Contact with Moving Oil
- No Metal Contact

Bowser turbine oil reconditioners point the way to *longer bearing life* as the most direct approach to *lower operating costs.*

TO OPERATIONS MANAGEMENT

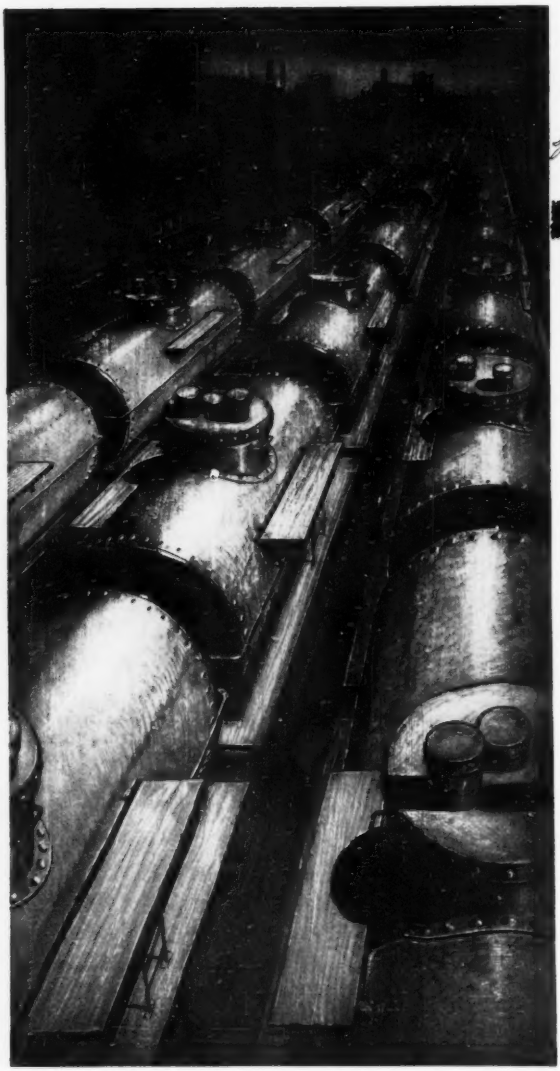
Bowser insulating oil and turbine oil reconditioners are effecting substantial reductions in operating costs in many plants. Less standby equipment is required.

If there's an "economy drive" on in your plant, you'll want complete details NOW! Bowser will help you work out a plan tailored to your needs. Write, wire or phone!

BOWSER, INC.
1384 Creighton Avenue
Fort Wayne 2, Indiana

LIQUID CONTROL SPECIALISTS SINCE 1885

All from the same batch



All the U·S·S Creosote Oil in these cars . . . in fact, *all* U·S·S Creosote Oil . . . is from the same batch. That's because batching is a continuous operation at the world's largest tar distillation plant, where U·S·S Creosote Oil is produced.

The result is a completely uniform product . . . and a uniformly *good* product. You know exactly what you are getting, and you can predict accurately the results of its use.

For example, you can count on years of extra service from poles that have been treated with U·S·S Creosote Oil. You can count on complete protection against dry rot, fungus, termites and other wood destroyers. You can count on lower yearly pole replacement costs.

U·S·S Creosote Oil is *proved* protection for your property. For more than 20 years, the nation's leading utilities, railroads, contractors and wood treaters have taken advantage of this method of preservation.

Whether you need a tank-car load or a full barge, we offer prompt delivery. Meanwhile, if you have any questions concerning Creosote Oil and what it can do for you, feel free to consult us. There's no obligation.

COAL CHEMICAL SALES DIVISION
United States Steel Corporation Subsidiaries
71 Broadway, New York 6, N. Y.

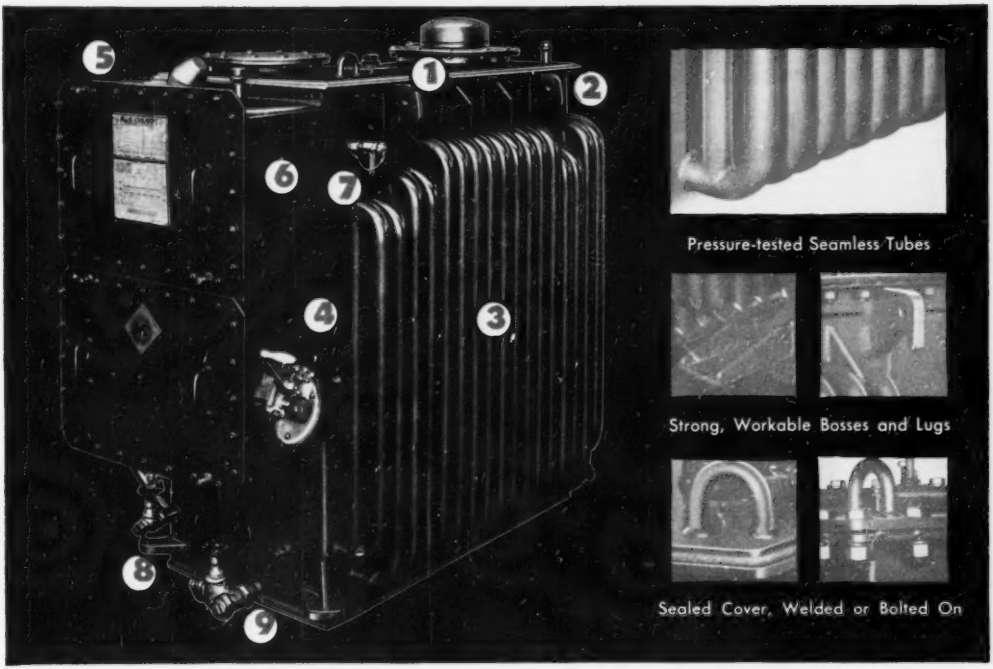
USS

CREOSOTE OIL

UNITED STATES STEEL

BEAT CORROSION! FLOODING! SUBMERSION!

With Allis-Chalmers Network Transformers



SERVING concentrated metropolitan loads, Network Transformers must operate dependably under the most adverse conditions.

These TANK CONSTRUCTION FEATURES show how Allis-Chalmers builds Network Transformers to combat corrosion, flooding, even complete submersion: —

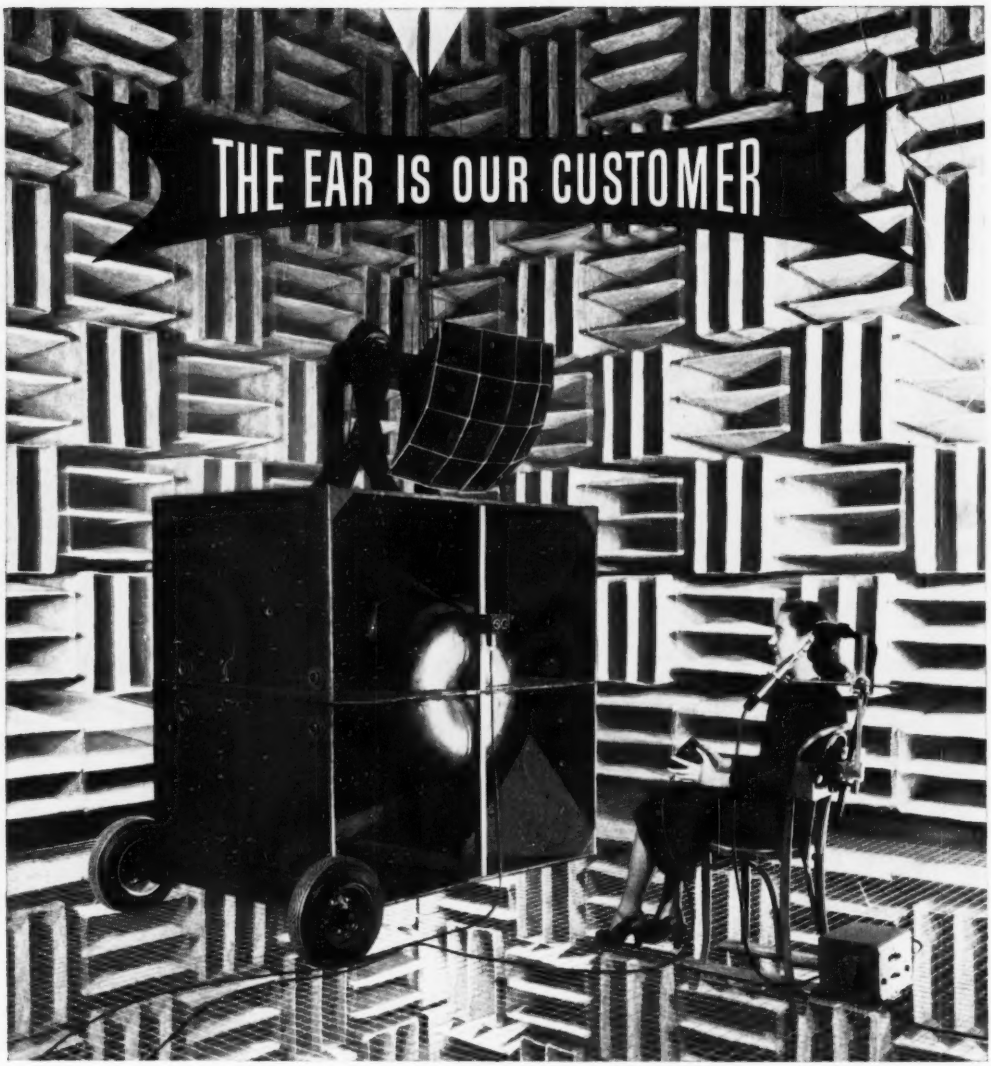
1. Heavy tank cover (½" thick), welded or bolted on.
2. Guide angles on inside of tank wall provide positive positioning of core and coils.
3. Heavy gauge steel tank . . . seamless drawn radiating tubes. All nuts, bolts etc. galvanized.
4. Switch case and terminal chamber welded directly to main tank eliminates gasketed joint and reduces overall height.
5. Three coats of paint — each coat flow painted and baked on.
6. Seams and joints externally welded to eliminate crevices.
7. Tanks and cooling tubes are pressure tested far in excess of operating conditions.
8. Jack bosses free of obstructions for convenient lifting.
9. Design of base permits free rolling in any direction — provides for undertank ventilation.

For the *complete* story of A-C Network Transformers — including circular core and coil design, no-load tap changer, accessories etc. — contact your nearby district office. Or write for fact-packed 24 page bulletin 61B6152A. A 2601

ALLIS-CHALMERS, 932A SO. 70 ST.
MILWAUKEE, WIS.

ALLIS-CHALMERS

Network Transformers — Nearly 1,000,000 KVA Installed



What happens when you hear? What happens *inside* your ear when sound waves come in from a telephone conversation?

Bell Telephone Laboratories scientists have developed special apparatus to help answer these questions, for the telephone system is designed to meet the ear's requirements for good listening.

In the test pictured above, the young lady sits before loudspeakers in a soundproofed room with a small hollow tube, reaching just inside the ear canal. Sounds differing slightly in frequency and intensity come from a loudspeaker. The subject seeks to tell one from another, recording her judgment electrically by pressing a switch.

Meanwhile, the same sound waves pass down the hollow tube to a condenser microphone, and a record is made of the exact sound intensities she identified. Results help reveal the sound levels you can hear clearly and without strain—the sounds your telephone must be designed to carry.

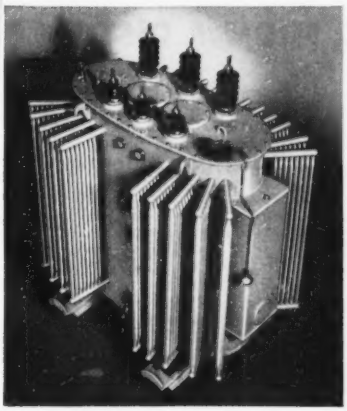
Scientists at Bell Telephone Laboratories make hundreds of tests in this manner. It's just one part of the work which goes on year after year at the Laboratories to help keep Bell System telephone service the finest on earth.

BELL TELEPHONE LABORATORIES

Exploring and inventing, devising and perfecting, for continued improvements and economies in telephone service.

If you are interested in saving money, find out about

Pennsylvania STANDARD PARTS POWER TRANSFORMERS



The use of standard designs and parts shorten engineering and production time to give you lower prices and faster deliveries.

That's right! The economies we realize in manufacturing Standard Parts Power Transformers are passed on to you in the form of lower prices (prices are 4% to 6% less than conventional transformers) and faster deliveries. Pennsylvania Standard Parts Power Transformers permit limited variations, both in parts and in electrical characteristics, to meet a wider range of system requirements. It will pay you to look into this line of Power Transformers which provides the desirable features of custom built transformers at quantity production prices.

PREFERRED VOLTAGES AND BAND OF RATED VOLTAGES	
PREFERRED HIGH VOLTAGES	RANGE OF RATED HIGH VOLTAGES LINE TO LINE
2400	. . .
4800	. . .
6900 } 7200 }	6600 to 9050
12000 } 13200 } 13800 }	11000 to 14750
22900	21500 to 24600
26400 } 34400 }	26400 to 36200
43800	42000 to 46000
67000	63000 to 69000

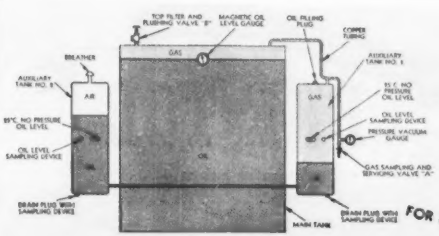
Auxiliary compartments, welded to each end of the transformer and connected to each other and to the main tank, form the following oil preservation systems:

Inert Gas-Oil Seal

Sealed Tank

Inert Gas Pressure System

All Standard Parts Power Transformer tanks, regardless of the type of oil preservation, are filled with the same quantity of oil, with the extra gas and oil spaces provided in the auxiliary tanks. Bushings with standard length shanks are used on all Standard Parts Transformers, and no special-size bushings need be stocked. This permits the user to change the method of oil preservation from Sealed Tank to Inert Gas-Oil Seal; and from Inert Gas Pressure System to Inert Gas-Oil Seal or Sealed Tank.



DIAGRAMMATIC DRAWING OF INERT GAS-OIL SEAL SYSTEM

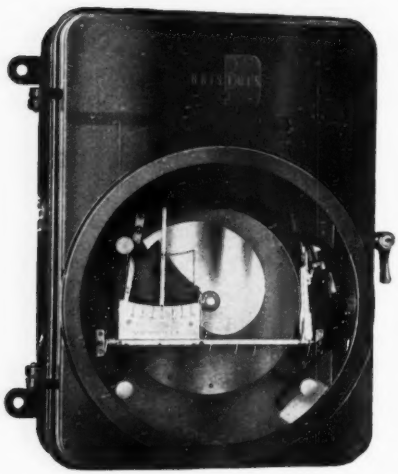
Pennsylvania
TRANSFORMER COMPANY
PITTSBURGH 12, PENNSYLVANIA

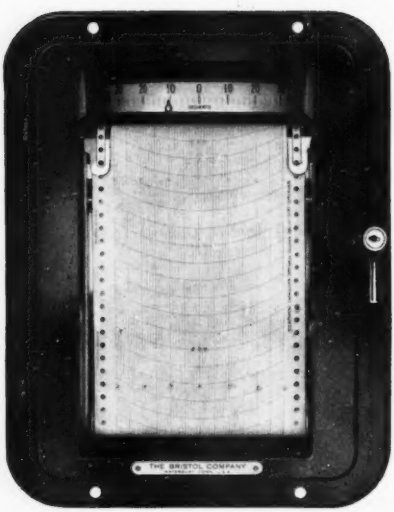
FOR FURTHER INFORMATION WRITE FOR BOOKLET NO. 1492

Pennsylvania TRANSFORMERS

HOW TO PREDICT AND PREVENT TROUBLE FROM A DISTANCE

LOAD CONDITIONS MEASURED AND TRANSMITTED HERE
RECORD OF LOAD HERE
CAN BE ANY DISTANCE APART
POWER SUPPLY
TRANSMISSION VIA CARRIER CURRENT
POWER SUPPLY
META-WATTMETER TRANSMITTER AT REMOTE POINT IN ELECTRICAL SYSTEM
RECORDING METAMETER RECEIVER IN LOAD DISPATCHERS OFFICE





Accurate readings of Voltage, Current, Power, Reactive Volt Amperes, and Totalized Load miles away come to you promptly and continuously when your system is watched and reported on by Bristol's Metameter System of Telemetering.

Observations picked up at remote points are recorded by Metameter Receivers at the central station or dispatcher's office . . . give you a complete and visual picture of what is taking place in your system . . . enable you to anticipate abnormalities and prevent emergencies from developing.

The impulse-duration principle on which the Bristol Metameter System of Telemetering works gives you a choice of transmitting media: carrier channel . . . simple two-wire circuit . . . radio beam . . . or any convenient circuit you may select. For full description, write for Bull. M1702. THE BRISTOL COMPANY, 116, Waterbury 91, Conn. (The Bristol Co. of Canada, Ltd., Toronto, Ont. Bristol's Instrument Co., Ltd., Lynch Lane, Weymouth, Dorset, England.)

Among uses of the Metameter are:

FOR LOAD DISPATCHER OF CENTRAL STATION SYSTEM

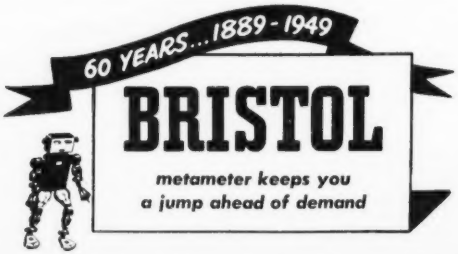
1. Load (active and reactive power and power demand) in each tie-line interconnecting system with neighboring system.
2. Output, or total generated power, of each generating station.
3. Total output of all generating stations, on a single instrument.
4. Active and reactive power and power demand at key points on important transmission circuits.
5. Water level and waterwheel gate position in hydro-electric plant.

FOR OPERATOR OF GENERATING STATION

1. Total output generated in system.
2. Output of each associated attended or unattended generating station in system.
3. Desired output of operator's own station.

FOR DISPATCHER OF DISTRIBUTION SYSTEM

1. Total kilowatt load on unattended substations.
2. Bus voltage of unattended station.
3. Feeder amperes.



AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

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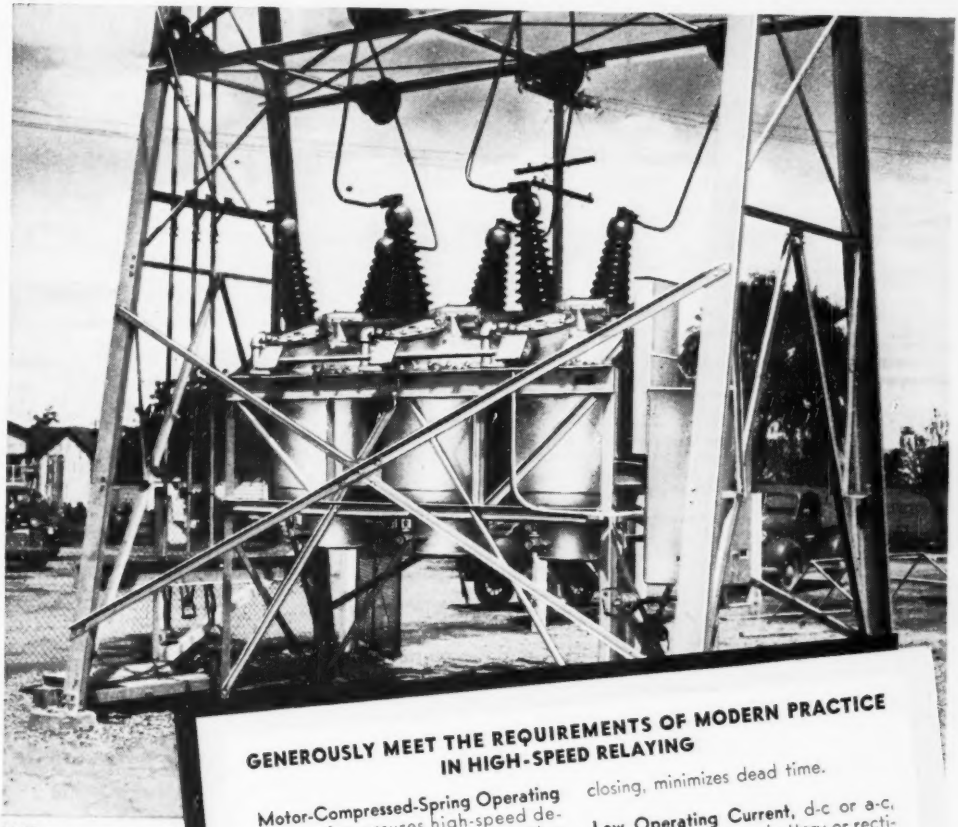
BREAKERS

69 kv, Type JE-42

Extra-Fast

Fault Interruption and Reclosures

by Motor-Compressed-Spring Stored-Energy Operating Mechanism



Type JE-42E
69 kv 600 amps
1,000,000 interrupting kva

Type JE-42F
69 kv 1200 amps
1,500,000 interrupting kva

Fully Conform to
AIEE and NEMA
Adopted Standards

GENEROUSLY MEET THE REQUIREMENTS OF MODERN PRACTICE IN HIGH-SPEED RELAYING

Motor-Compressed-Spring Operating Mechanism assures high-speed dependable opening and closing, either automatic or manual; ideal for synchronizing.

High-Velocity Gas Blast, directed into the arc stream, rapidly extinguishes the arc within Pacific Electric Expulsion Chambers.

High-Speed Tripping, for opening and closing, minimizes dead time.

Low Operating Current, d-c or a-c, reduces or eliminates battery or rectifier expense.

Easy to Inspect and Maintain—Low upkeep even when fault interruptions are abnormally frequent.

Shipped Assembled—Fully tested and adjusted at the factory.

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Be specific – Don't just

TYPICAL TEST RESULTS ON RUBBER COMPOUNDS

Use this table

The tabulation below lists representative values that have been obtained in actual tests of these rubber compounds.

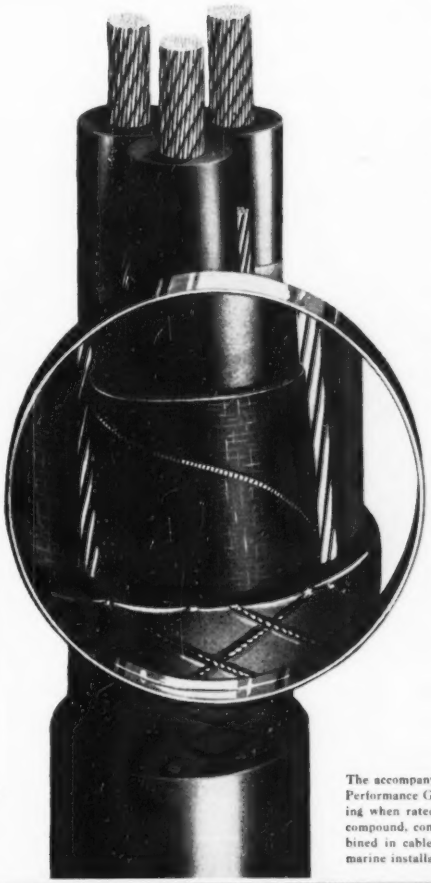
PROPERTIES AND TESTS		REPRESENTATIVE TEST VALUES FOR VARIOUS COMPOUNDS						
		AMARINE —40	AMERZONE —O	AMERZONE —B	AMARINE —RWS	AMERITE	AMPEROX	AMERPRENE
BASIC TYPE OF INSULATION		Natural Rubber	Oil-base	Butyl Rubber	Synthetic Rubber	Commercial 30%	Heat-Resistant	Polychloroprene
MAX. REC. COPPER TEMP.		60°C	75°C	80°C	75°C	60°C	75°C	80°C
ELECTRICAL CHARACTERISTICS	Dielectric Constant (Spec. Ind. Cap.)	4.0	4.0	4.0	4.5	4.5	4.5	....
	Ins. Res. (K)	50,000	7,500	40,000	30,000	30,000	20,000	100
	Dielec. strength in volts per mil	450	350	300	400	400	350	200
PHYSICAL PROPERTIES	Tensile Strength in lbs. per sq. in.	2000	600	700	950	1000 Synth. 1500 Nat.	1000 Synth. 1800 Nat.	2000
	Elongation in 2"	450%	300%	400%	450%	500%	500%	500%
	Permanent set	¼"	½"	⅜"	⅜"	¼"	¼"	¼"
ACCELERATED AGING	Type of test	Geer Oven	Geer Oven	Geer Oven	Oxygen Bomb	Geer Oven	Oxygen Bomb	Geer Oven
	Temperature	70°C	80°C	100°C	80°C	70°C	80°C	80°C
	Hours	288	168	672	168	504	336	168
	% Original Tensile Strength	70%	80%	80%	80%	85%	80%	90%
MOISTURE RESISTANCE	Gain in wt. after 7 days immersion at 70°C (Mg. per sq. in.)	25	....	20 or less	15 or less	35	35	30-60
	Capacity increase after 4 weeks immersion at room temperature	15%	15%	15%	10%	15%	15%	....
	Stability Factor 40-80 volts per mil 2 weeks at 50°C	.5%	1.5%	1.0%	.8%	2.0%	3.5%	....
SPECIAL PROPERTIES		High Voltage and Submarine use	Meets IPCEA ozone test	Withstands .03 conc. 10 hours	For hot and moist locations	General purpose rubber insulation	General purpose rubber insulation	Resistant to oil, flame and ozone

As the test data vary considerably with different sizes of conductor and thicknesses of insulation, these identical results can not be guaranteed throughout the whole range of sizes and voltage ratings. Some specific constructions will test higher and others will test lower than the listed values. However, the above table indicates in general what may be expected of these compounds.

AMERICAN STEEL & WIRE COMPANY

say Rubber

for detailed specifications



THE buyer of rubber-insulated cable today is faced with the dilemma of choosing between natural rubber, synthetic rubber, and a dozen different compounds of each.

The American Steel and Wire Company has always advocated the use of special rubber compounds to meet special requirements. To help you choose the right rubber compound, we recommend that you—

Specify	For
AMARINE-40	High voltage service under ground or under water, for all submarine power cables and for general use above 7500 volts.
AMERZONE	Ozone-resistance. Amerzone-O is an excellent oil-base compound. Amerzone-B is a butyl rubber compound that is highly resistant to heat and moisture as well as to ozone.
AMARINE-RWS	Hot or damp locations. This is a compound notable for having low water absorption combined with excellent heat resistance.
AMERITE	General use up to 7500 volts. A compound of the performance type recommended for use where copper temperatures will not exceed 60°C (140°F).
AMPEROX	General use up to 7500 volts where a heat-resistant compound is required for operation at copper temperatures up to 75°C (167°F).
AMERPRENE	Flexible jackets. Owing to its high content of Neoprene, this compound is resistant to oil, flame and sunlight.

AMERICAN STEEL & WIRE COMPANY, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA STEEL COMPANY, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM, SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

The accompanying illustration shows one of our standard constructions with Amerite Performance Grade around conductors; conducting rubber tape for non-metalic shielding when rated over 2000 volts. The cover is of Amerprene, a tough, hard-wearing compound, containing a high percentage of Neoprene. These compounds can be combined in cable constructions to fit the requirements of industrial, mining, and submarine installations.

USS

AMERCLAD CABLES

UNITED STATES STEEL

What's the COST of "low-cost" hauling?

THE cost of *any* truck is the total amount of money you invest in it . . . as long as you own it.

That cost is usually far different from the truck's original price!

It can be far higher, for example, when you buy a truck that's too big or too small for the hauling job it has to do.

In such cases, costs go up rapidly . . . in wasted gas and oil, in repairs, in shortened truck life, in time lost on the job.

It's important, therefore, that *your* truck be engineered and built . . . to fit *your* job! That's what is meant by a "*Job-Rated*" truck!

Only Dodge builds "*Job-Rated*" trucks. Every one of these trucks has the right one of 7 truck engines . . . "*Job-Rated*" for top efficiency and maximum economy. Every Dodge has the *right* chassis unit . . . from engine to rear axle . . . "*Job-Rated*" to fit *your* job, to save *you* money.

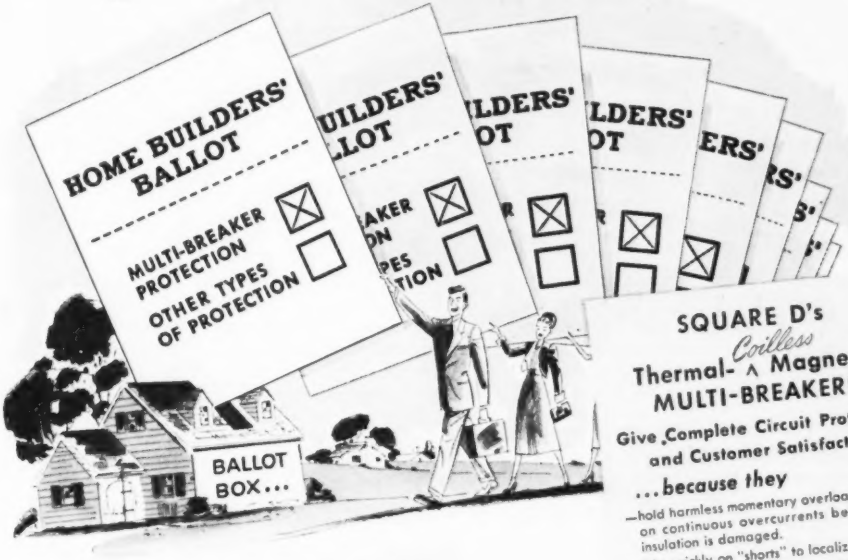
So if you're looking for the "*lowest-cost*" truck . . . ask your Dodge dealer to show you the "*Job-Rated*" truck that fits *your* job! Such a truck will give you the best *value* in transportation you can buy.

See or Phone Your Dodge Dealer

For the good of your business—

Switch to DODGE "Job-Rated" TRUCKS

there are 6 good reasons for using MULTI-BREAKERS to build bigger, better, more profitable wiring jobs!



Reason #3 PEOPLE PREFER MULTI-BREAKERS!

Thousands of electrical contractors have proved this in actual practice . . . when they explain the advantage and conveniences of the Multi-breaker, home-builders invariably choose it over other types of circuit protection.

After all, those new homes represent the most important investment of a lifetime. The small additional cost of a Multi-breaker installation is negligible when compared with complete protection, safety and convenience over a lifetime of comfortable living.

Multi-breaker wiring jobs are easiest to sell—they stay sold because they're right. They're emphatically right from the Utilities standpoint because they reduce costly service calls—build valuable customer goodwill.

Would you like to know the five other reasons—as we're presenting them to electrical contractors throughout the country? Write the Square D Company, 6060 Rivard St., Detroit 11, Michigan. We'll mail them, pronto.

SQUARE D's Thermal-Coilless Magnetic MULTI-BREAKERS

Give Complete Circuit Protection and Customer Satisfaction

...because they

—hold harmless momentary overloads but trip on continuous overcurrents before wire insulation is damaged.
—trip quickly on "shorts" to localize damage.
—give repeat protection. No parts burn out—nothing to replace.
—are non-tamperable. Factory test-tripped and sealed.
—are safe. No live parts exposed. Anyone can operate them.
—include switching means as well as circuit protection.
—are compact. Room for expansion without excessive space.
—are attractive. Can be installed in most convenient location.

SQUARE D COMPANY

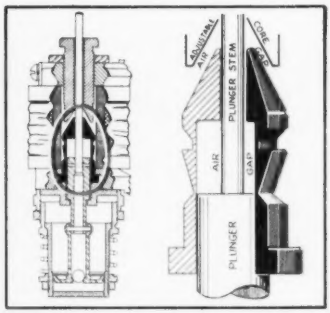
DETROIT • MILWAUKEE • LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

Complete MOTOR PROTECTION

Under All Conditions with these EC&M Overload Relays

Instantaneous Trip; also Time-Delay Operation for Single Phase, Failure to Start, Running, Etc. — all in this one Relay.



Special Iron Sleeve with tapered wall thickness provides magnetic balance, permitting *low* current setting.

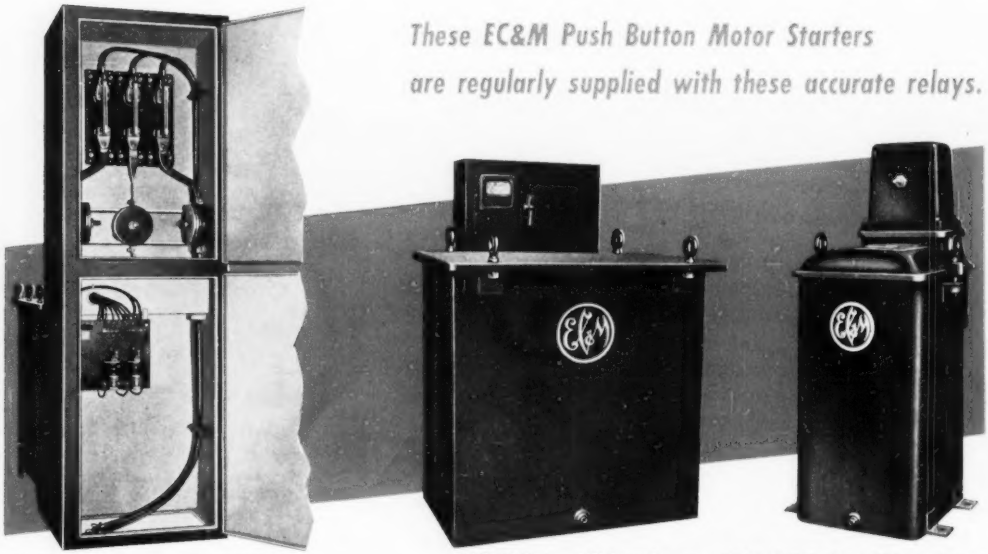
EC&M Type ZM Overload Relays for use in A-c Starters are of the magnetic type. They trip *instantly* on heavy overloads or short circuits and provide *inverse-time-element* trip on prolonged overloads or if the motor fails to start.

A *low* current-setting for accurate protection under running conditions is possible with these Relays because a magnetic-balance in each relay permits the absorption of the heavy inrush currents while the motor is accelerating. When the current is normal, the relay drops back automatically to keep timing at the maximum.

On short circuits the time-delay feature is by-passed. A spring on the outside of the dashpot-case normally holds the dashpot down, allowing the plunger to pull through the silicone fluid. When an excessive current occurs, the dashpot and plunger lift as a unit—the outer spring on the dashpot being compressed as the plunger *instantly* rises to trip the relay-contacts without delay.

Complete description of these Relays is given in Bulletin 1180-2 and No. 19 ACCELERATOR. Write for your copies.

These EC&M Push Button Motor Starters are regularly supplied with these accurate relays.



VALIMITOR Starters — 2300-4600 Volt Motors

2300 V. Reduced Voltage Starter

220-550 V. Reduced Voltage Starter

THE ELECTRIC CONTROLLER & MFG. CO.

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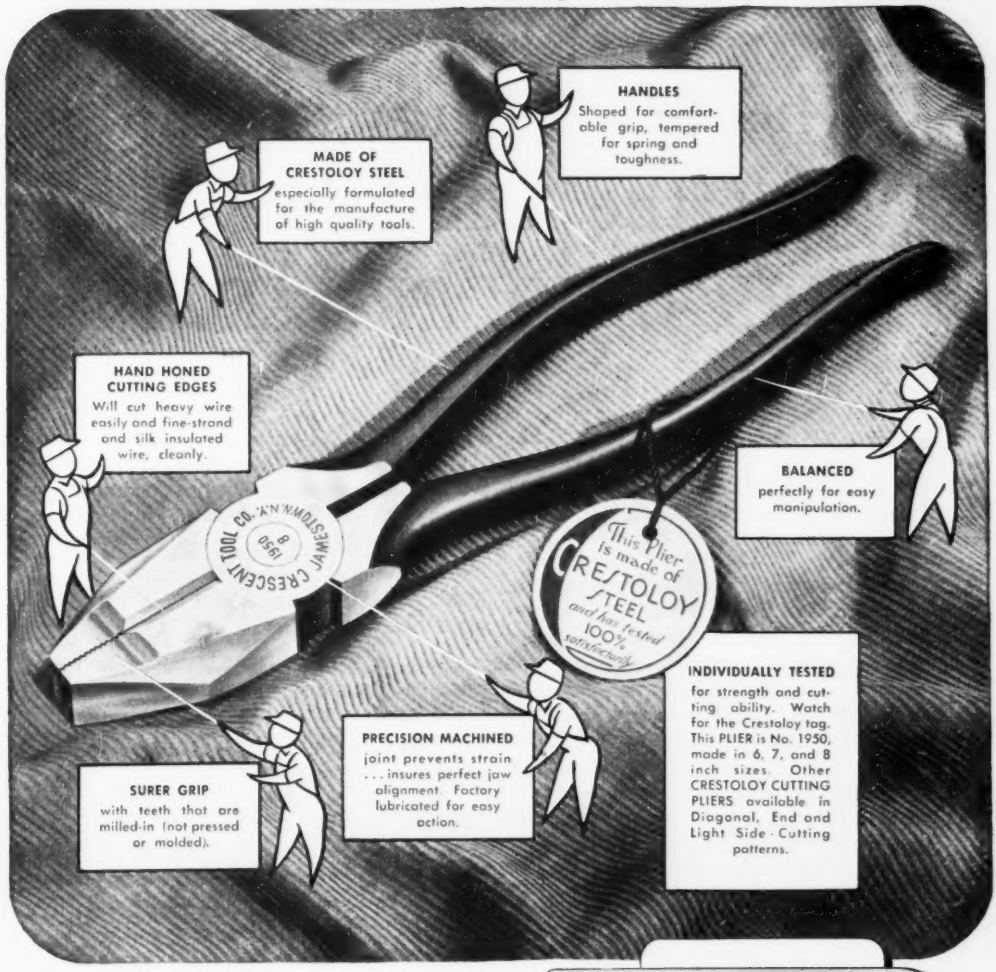
SIDE-CUTTING PLIERS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Shaped for comfortable grip, tempered for spring and toughness.
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especially formulated for the manufacture of high quality tools.
HAND HONED CUTTING EDGES
Will cut heavy wire easily and fine-strand and silk insulated wire, cleanly.
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perfectly for easy manipulation.
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This Plier is made of CRESTOLOY STEEL and has tested 100% satisfactorily
INDIVIDUALLY TESTED
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joint prevents strain . . . insures perfect jaw alignment. Factory lubricated for easy action.
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with teeth that are milled-in (not pressed or molded).

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CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

"Give us the tools . . ."

The 81st Congress Can Halt the Administration's *SOCIALIST PROGRAM*

In his speech at Massachusetts Institute of Technology, Winston Churchill said that America's possession of the atomic bomb is all that has kept Soviet Russia from overrunning Europe and bombing London.

Our State Department knows that there has been another deterrent to aggressive warfare by Russia and a deciding one. That deterrent is the superior industrial strength of the United States. But once Russia approaches our industrial strength, then watch out! For Stalin or no Stalin, there will be trouble. Therefore, the simple table below is worth every American's careful reading. It shows in percentages what Russia did with her national income in 1948 and what we did with ours:

	USSR	USA
Civilian use	60%	79%
New capital equipment and public works	21%	12%
Foreign aid		2%
Defense	13%	5%
Building of inventories and war stock-piling	6%	2%

These figures for Russia come from *The* (London) *Economist*, Britain's influential economic journal.

These figures are estimates based on information from behind the Iron Curtain, and so cannot be checked directly. But they fit with what is known of Russian development.

The table shows that Russia is straining every resource to build up its industrial strength. When Russia's effort is measured in *dollars*, and compared to ours, the figures show:

Where we spent $20 to $21 billion for new industrial plants and equipment last year, the Russians spent $12 to $14 billion.

But while we used about $9 billion of this to *replace* old equipment, the Russians spent no more than $2 billion for replacing old equipment. The Russians had much less worn-out and obsolete equipment to replace. They could concentrate their efforts on expanding their industries and buying new equipment.

So—we used only $11 to $12 billion to *expand* our industries.

And the Russians used almost as much to expand theirs—$10 to $12 billion.

Russia is gaining industrial strength as fast as we are—and may soon be gaining faster. The more she gains and the faster she gains on us, the greater is the danger of war.

continued on next page

American industry is pushing modernization and expansion hard. It is doing an heroic job. McGraw-Hill's recent survey* shows that *industry* already has in hand plans to build plants and buy equipment in the next five years adding up to $55 billion. Industry plans that investment—*and much more—if it can get the money.*

On those plans of *industry* depend *our* national security.

If these plans of ours are cut back, the Russians will be years closer to their goal of industrial equality—the strength that they need to wage aggressive war successfully.

But more and more our industry's plans are being menaced by socialist policies in Washington. The President continues to urge a further increase in the tax on corporate profits, even though federal taxes alone now take 38 cents of every dollar of profit. He wants $3 billion more in taxes on corporate profits now, plus added personal taxes.

Last year corporations spent almost two-thirds of their profits—about $13 billion—for new plant and equipment. This year corporation profits will be lower than last year's $21 billion, perhaps by 20 per cent. Subtract a fifth or more from last year's profits. Then adopt the President's proposal and take $3 billion more in corporate taxes and you raise havoc with planned expenditures for new plant and equipment.

Approval by Congress of the President's tax program would cut industry's program of plant and equipment development by a third or more. That means a major blow to our prosperity as well as our national security. For as capital investment goes, so goes general prosperity.

Further serious damage would be done by Congressional approval of the President's industry-control bill. The so-called Stability Act of 1949 (the Spence Bill) would severely check industrial progress. That bill would put the federal government in the business of providing the added industrial capacity which the tax program would prevent private industry from doing for itself. It would be hard to conceive a better and surer way to dry up private investment in new plant and equipment. For every dollar of government investment will scare away many times more dollars of private investment. People will not want to risk their money in businesses competing with the U. S. Treasury. At the same time it will attack private investment in another way. It means that government would spend your income for you instead of allowing you to spend or invest for yourself. That is the high and quick road to socialism.

American industry needs right now great courage and incentives if it is to carry out its tremendous building program. It needs also a release from the program of a socialist administration in Washington with its systematic discouragement of enterprise and risk taking.

Above all, industry needs assurance by the actions of the 81st Congress itself that there is a future in this country for a system of dynamic capitalism, functioning in a free society. By acting now to strengthen the American people's faith in their industrial system, by providing needed incentives for management and investors, by protecting industry's capacity to buy new equipment, the 81st Congress can sustain American industrial progress and keep us united and strong.

But if we kill freedom of industrial planning and action by unneeded taxes and government controls we put ourselves—and our friends all over the world—in dire peril.

Nothing would please the Communists more.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

***A complete report on our national survey may be obtained by writing McGraw-Hill Publishing Co., 330 West 42nd St., New York 18, N. Y. This is one of a special series of editorials on industry's needs for new plants and equipment.**

THERE'S A NATIONAL ELECTRIC FLEXIBLE WIRING SYSTEM *for every housing job*

10-8--600V- - - - National DILEC SAFECOTE -
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Underwriters' INSPECTED
NON-METALLIC SHEATHED CABLE

2 TYPES OF NE BUILDING WIRE

Dilec Safecote (Type R) Rubber insulation covered with a flame-resistant, saturated fibrous serving. The durable colored coating is marked and measured . . . Free stripping . . . Moisture resistant . . . Smooth finish for easy fishing . . . A quality-built wire for general building purposes.

NE Thermo-plastic (Type TW) High resistance to moisture, acids, alkalies, oil and grease . . . Wide range of permanent colors, marked and measured . . . Use NE Type TW where conditions are unusually moist or hot.

2 TYPES OF GALVANIZED, FLEXIBLE-STEEL ARMOR PROTECTION

Flexsteel—Flexible Steel Conduit. Used with either Dilec Safecote or NE Thermo-plastic wires, Flexsteel provides an approved, grounded pull-in and pull-out system. Rounded channel construction makes fishing easy. A conduit system with no waste.

A. B. C. (Armored Bushed Cable) Besides the grounding provided by the "bondhook" channel construction of A.B.C. Cable, sizes 14 and 12 also have a *low resistance* grounding strip. Anti-short bushing protects conductors against sharp cut edges of steel. A.B.C. is furnished *complete* with Dilec Safecote or NE Thermo-plastic wire.

2 TYPES OF NON-METALLIC SHEATHED CABLE

Canvas-Back Loomwire—A new, small diameter cable that eliminates paper stripping. (No kraft wrappings to strip back). Has a saturated, fire-resistant cotton braided sheath. Each conductor carries full insulation to the terminal screw.

NE-o-Prene Loomwire—The *first* Neoprene-sheathed Loomwire to be listed by Underwriters' Laboratories, Inc. Ideal for barns and other wet locations where rot, fungus, moisture, ammonia-ladened air and drastic weather changes are destructive to other types of approved wiring. The toughest, most durable non-metallic sheathed cable available.

Complete Lines of Accessories for all wiring systems: Boxes, connectors, lugs and fittings.

All National Electric wires, cables, conduits, raceways and accessories are listed by Underwriters' Laboratories, Inc.

NATIONAL ELECTRIC PRODUCTS — NE — WIRING SYSTEMS 6 — WIRES AND CABLES

Sold through leading electrical wholesalers
Installed according to National Electrical Code.

National Electric
PRODUCTS CORPORATION

1305 CHAMBER OF COMMERCE BUILDING, PITTSBURGH 19, PA.

Is Municipalization Next?

"It seems to me that the severest test to the electric companies will come in the form of moves for municipal ownership, for public utility districts, or other such government creations where the real consideration will be the familiar problem of balancing tax avoidance by the government operator on one hand and good service and local tax payments on the other hand."

The comment, made by EEI's Col H. S. Bennion before the recent Southeastern Electric Exchange meeting, is a bald recognition of what may inescapably be the next expansion of public ownership in the electric power industry. It isn't to say, of course, that the predominance which federal public power has enjoyed for a decade and one half is to be eclipsed. Not with about $40 billion worth of power-dependent water control projects on paper, it isn't. Not with $317 million annual appropriations for the Reclamation Bureau, nor so long as flood control and river and harbor work command $558 million in one year.

But the very magnitude of these federal power development figures furnishes the best proof for the thesis Colonel Bennion asserted. When funds of such proportions have been spent, there will be a lot of new power to be marketed. It is the usual practice of federal divisions to market such power through state, municipal, or other nonprofit and non-taxpaying agencies. It is not federal policy to engage in electricity distribution. How, then, can anything be expected other than an end to the relatively moribund state of municipalization of distribution systems? The Missouri Basin looks like the first big, new field that can be opened for such federally instigated and supported municipalization. But one look at the map shows that it may be followed by many more. Perhaps the Southeast can go farther and faster than the Missouri Basin in the federal drive for publicly owned distribution.

"What," asked Colonel Bennion of his SEE audience, "will keep a service vital to the public from being socialized?"

There are answers to that question in plenty. So far as the federal government is concerned, it can be only because "Rome wasn't built in a day." But the federal government, powerful as it is, doesn't have the final say on complete public power ownership. An even more impressive answer is Colonel Bennion's own:

"A good record of adequate, dependable, high quality service; character, capability, and responsiveness of the individual employees, from the president to the newest employe; keeping right on the job; a live and promising record of technical and commercial advances; a history of sound rate or price policies defensible against provocative comparison or well-aimed competition; and, not to be disregarded, are a successful and open financial record; a general and well established reputation for good leadership, for a progressive spirit, for engineering and operating excellence and for responsible, willing, and helpful participation in community affairs. People have demonstrated time and again that they like or are proud of leaders of character and standing in their communities, leaders who are sincere, straight-forward, energetic, resourceful, progressive and able to give a good account of their stewardship."

Threatening as the drive for municipalization is, the belief remains that it will not eradicate private power operations which are based on such principles—and which meet them.

Still in the Vigor of Youth after 75 Years

Our Fiftieth Anniversary

An Editorial in ELECTRICAL WORLD, *September* 20, 1924

WITH this issue, the ELECTRICAL WORLD celebrates its semi-centennial. Fifty years, to be sure, is not a long time; but in fifty years the nation has risen to triple its former strength and in fifty years the industry which the ELECTRICAL WORLD represents has grown a hundredfold. Then it was a dream, a nebulous fancy, without form or purpose. Now it is one of the basic industries of the country, destined before long to become the largest because it pervades all others.

Now, age of itself signifies nothing unless it be signalized by accomplishment. The ELECTRICAL WORLD was identified with the industry before electric lighting came into general use. It witnessed the rapid evolution of that industry from practically nothing to its present vast proportions. Well might it say with Virgil: "All of these things I saw, and a great part of them I was." And yet while the editors and publishers realize the splendor of the tradition and of the inheritance which they hold in their hands, they do not associate the ELECTRICAL WORLD with age; it is, they know, still in the vigor of youth.

History teaches us that change is inevitable and that progress is eternal. What vast changes have been made in the ELECTRICAL WORLD from the days of the *Operator* to the present time, and what accomplishments and progress have been recorded! Through all the transient and rapidly shifting phases of the science and art, the publication developed with the industry it serves, and always maintained its position of pre-eminence. Always it has renewed itself. Always it has known how to adapt itself to changing and oftentimes perplexing conditions. Bringing inventive intelligence and suppleness of mind to bear upon its problems, it has seen them vanish one by one as it advanced. If it has modified its method, if it has altered its mode of life, it has always preserved beneath the outward semblance of change the institutional characteristics of virility, stability, independence and idealism.

To trace an art from its inception, to note changes and improvements as they occur in it, to follow its ramifications from the realm of speculation to the abode of fact, to correlate its achievements with advances in allied and kindred arts, and to keep the industry enthusiastic and enterprising, is not an easy task for any publication. None could reach or long hold the place occupied by the ELECTRICAL WORLD unaided. It is the hearty support and good will of its hosts of readers and friends throughout the world that have made it a factor in the industry to which its loyal service has been given. The industry's cause has always been the ELECTRICAL WORLD's cause, and for the industry's sake no effort is too great, no duty too onerous. But it takes time to make friends and age to build tradition. We look to gardens old and matured, to soil that has bred fine blossoms to breed them again, knowing that the garden which has been well tended will yield the choicest flowers.

To have been a part of the electrical industry, to have helped in its upbuilding and to have recorded its progress has been the privilege of the ELECTRICAL WORLD for half a century. How well it has fulfilled its mission others must tell. Men prominent in the industry who in this number trace the developments of the past five decades point also to the part the ELECTRICAL WORLD has played in them. The tributes contained in articles and letters are flattering indeed. They make it unnecessary for us to say much in our own behalf; for no better or more tangible evidence of worth is obtainable than the commendation and approval of readers. We appreciate these tributes and shall cherish the approbation expressed in them because it imparts new courage and inspiration of greater things yet to be.

The Electrical Week

Electric utilities at the present time may be having a hard time finding engineers and skilled workers. But times are changing. A study made by the Bureau of Labor Statistics shows that for most classifications of engineers and skilled help there will be a buyers' market by the end of the year . . . In Washington, the Federal Communications Commission announced its permanent rules for general mobile radio services. All utilities get exclusive use of 42 frequencies in three bands. They share use of a number of others . . . AEC's chief of reactor development has announced that it will be a long time before any nuclear reactor tests are made. There is a good reason. It will be a long time before there are any reactors to test . . . And energy output last week fell to the lowest point since last July, holiday weeks excepted.

The New Jersey CIO has an eight-point platform which it wants both Democrats and Republicans to include in their election platforms. Two of the planks are the appointment of consumer and labor representatives on the Public Utility Commission and repeal of the utility anti-strike law.

Maybe Congress was right in reducing construction funds for the Corps of Engineers and the Bureau of Reclamation. The Public Roads Administration has reported that bids for highway construction in the first quarter of 1949 showed their first decline since 1940. But the decline was nowhere near the 15% ordered by Congress on the assumption that construction costs would drop.

A press agent for Ekco Products Co says that one manufacturer of electric ranges is using the copper-clad cooking utensils (Ekoware) for demonstration and display items and as premiums in lieu of a trade-in. The latter use, he says, has an added virtue. It makes for consumer satisfaction by insuring that effective cooking utensils are used with the new range.

Electric utilities have been paying out substantially more of their net earnings in dividends than have industrials. But at least one Wall Streeter thinks they should pay out more—and would benefit if they did. He has a study of 65 operating electric or electric and gas utilities, whose common stocks sell at an average price-earnings ratio of 10.3 times. Of these, 31 which sold at an average of 8.3 times earnings were paying out 58% of net. The historic average price-earnings ratio for a group of ten of these 65 companies, over the 22 years through 1947, was 13.6 times. Their average payout through that period was 82%.

The United Electrical Workers, CIO, has set its goal for a fourth-round wage increase. The goal: $500 per year per employee. But it need not all be in cash. Pension improvements, health programs, and other economic benefits will be acceptable for part of the total.

Qualified linemen continue to be in short supply in the Pacific Northwest. Portland General Electric Co is starting an accelerated one-year training course after losing 18 linemen during the first three months of 1949. Only 24 journeymen completed the former three-year apprentice program from January, 1947, to March, 1949.

Appalachian Electric Power Co had more than 9,000 visitors in its new Roanoke office building in two days of a public showing. That's about 13% of the local population. Aepco kept count by giving each visitor one of the new GE diffused light bulbs.

How Times Change Dept—A decade ago, $55 million was a shocking amount of money to spend on a single multiple-purpose dam and power plant. Today, Congress has before it legislation (S. 1392) authorizing appropriations of $55 million merely for a "comprehensive plan for flood control in the Rio Grande Basin, New Mexico."

Regulation W—regulating installment selling—will be allowed to expire June 30. This should give appliance buying a healthy boost.

Notes From The News

The Rumford (Me.) Light Co has completed its change in frequency from 40 to 60 cycles. The job was done in less than 11 months and some 6,000 commercial and residential customers were involved . . . Formed at Kansas State College, Manhattan, on Apr 22, the Kansas Rural Electrical Advisers Association claims to be the first of its kind in the United States . . . Surplus power amounting to some 50,000 kw will be available to the Pacific Northwest from British Columbia late this year . . . R. M. Jefferies, general manager, South Carolina Public Service

Continued on following page

SHOVEL BRIGADE includes civic officials and business men of Natchez, Miss. They broke ground for the 66,000-kw steam plant which is being built for Mississippi Power & Light Co. New plant will cost $8 million and will have largest single turbo-generator in the state

Authority (Santee-Cooper) said the state-owned project is willing to pay a reasonable tax . . . Centralia, Wash., has retained James W. Carey & Associates, Seattle, to make an engineering-economic survey of its municipal electric system . . . A high-grade uranium deposit of unknown extent has been discovered in Pima County, Ariz . . . Because it is cheaper than to keep its old steam plant manned as a standby plant, Danville, Va., will maintain a contract with the Appalachian Electric Power Co.

A Federal Court has dismissed the $1 million suit of the United Electrical Workers against the Atomic Energy Commission and the General Electric Co. The suit grew out of AEC's failure to recognize a union contract covering workers in the GE atomic lab at Schenectady because UEW officials did not sign non-Communist affidavits . . . The prolonged drought in Italy has forced severe power rationing for non-industrial uses . . . The Federal Reserve Board has further liberalized installment credit regulations . . . An emergency radio network covering all Nebraska is being planned by the Consumers Public Power District. The system will consist of 26 transmitter stations and 180 mobile units.

Construction:

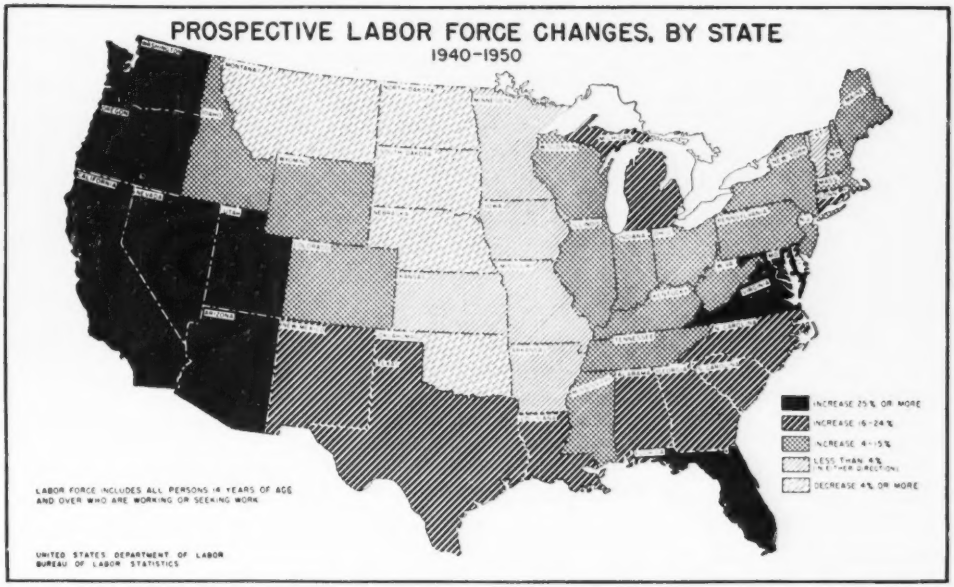
Electric companies in Wisconsin will spend $68,914,960 in 1949 for additions, improvements, and extensions to their generating plants and distribution lines . . . Attorney for the Warm Springs Indians told the Oregon Hydroelectric Commission conducting hearings on the proposed Pelton Dam on the Deschutes River that "we will want a little wampum" to give our approval. Under a treaty with the U. S., the Indians claim control of the river. The Oregon Fish Commission is also opposing the dam . . . Alabama Power Co has put into operation a 60,000-kw unit at its Gadsden Plant. Southwestern Gas & Electric Co has put into operation the second 33,500-hp unit at its Lieberman Plant.

Legislation:

The Vermont Legislature has killed participation by the state in a 10-year compact proposal for the six New England States to be administered by a New England Development Authority . . . Legislative efforts to revamp the Michigan PSC and its procedures have failed. All bills to these ends died in committee . . . The bill to exempt public utilities in Pennsylvania from the law giving municipalities power to tax anything not taxed by the state has been sent to the governor.

Financial:

The North American Co has postponed from July 1 to Sept 1 the partial liquidating distribution to its stockholders of 100% of the common stock of Kansas Power & Light Co. The delay is to provide time to effect a merger of the operating company with Kansas Electric Power Co. . . . The California Public Utilities Commission has granted exemption from the competitive bidding rule to Southern California Edison Co on its contemplated issue of 800,000 shares of additional common stock . . . Consolidated Gas, Electric Light & Power, Baltimore, plans to sell more common but has not announced how much or at what terms . . . The Connecticut PUC has granted the Connecticut Light & Power Co permission to issue 200,000 shares of preferred stock of no stated par value. The utility expects to raise $10 million from the issue . . . . Potomac Electric Power Co has received permission from the District PUC to sell 592,250 shares of new common stock on a negotiated basis. The issue will be offered present stockholders at the rate of one for five. Sales of $10 million first mortgage bonds at competitive bidding was also approved.


PROSPECTIVE LABOR FORCE CHANGES, BY STATE
1940–1950
INCREASE 25% OR MORE
INCREASE 16–24%
INCREASE 4–15%
LESS THAN 4% (IN EITHER DIRECTION)
DECREASE 4% OR MORE
LABOR FORCE INCLUDES ALL PERSONS 14 YEARS OF AGE AND OVER WHO ARE WORKING OR SEEKING WORK
UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

Highly Trained Workers Still Scarce

But Bureau of Labor Statistics Survey Shows End of Sellers' Market Is Approaching Rapidly—Colleges Graduating Engineers in Record Numbers

THERE's still a sellers' market for the kind of highly trained professional workers employed in the utilities field —but it's not going to last forever.

That's the Bureau of Labor Statistics' conclusion from surveys of 288 skilled and technical occupations.

Why, when unemployment among many types of workers is rising, is it hard to find trained men? BLS found that:

1. Technological developments during and since the war have sparked new industries, brought expansion to older ones. That meant recruiting new personnel—for the laboratory and the assembly line. The number of engineers employed, for example, rose from about 245,000 in 1940 to more than 300,000 in 1947—and still this wasn't enough.

2. While war needs were expanding, the draft was thinning down the number of college students training for technical jobs; from 1942 to 1945, nearly 25% fewer Ph D degrees were granted than in the preceding four-year period.

Since the war's end, however, students once more have been beating at the gates of technical schools and colleges. In engineering schools, enrollment has jumped to three times the prewar level. The first postwar graduates are already on the job. And each semester brings out a bigger crop.

Thus, it looks as though it will take only a few months to ease some of the shortages. Others will last only for another year or so. In two or three years, trained help will be plentiful in practically all fields.

But the labor market will not be the same for all industries or even for the branches of the same industry. Conditions will vary also in different sections of the United States. They always have.

Population has been increasing; so has the labor force. But the increase varied greatly because of migration during and after the war. On the Pacific Coast, in the Southwest and Southeast, the labor force increased from 16% upward. In the West Central States, there was a decrease. In most other sections, the increase followed closely the trend in population (See Map).

Two other population shifts are worth noting, since both will seriously affect the nation's economy. Percentagewise, the number of persons under 20 years is decreasing; and the number 65 and over is increasing, but not so rapidly. In the 20 to 64-year class, the greatest proportion of the labor force, the percentage increase has been slight. The other trend is the movement from the farm.

The Bureau of Labor Statistics has been studying the labor market in order to provide high schools, colleges, the Veterans Administration, and others employed in vocational guidance with a true picture of the opportunities awaiting youth. Results have been summarized in "Occupational Outlook Handbook." This is the way the book summarizes conditions in various fields.

Electrical engineers—Because electricity is taking more jobs in industry, the home, and on the farm, demand is growing. But supply is growing even faster. EE classes are about thrice as big as prewar. Deaths and retirements make necessary 1,000 replacements annually. After June electrical engineers should be plentiful. In another year, there should be an oversupply in many fields.

Mechanical engineers—Since most of these work in the metalworking industry, demand has reached its peak.

More likely, it is leveling or falling off. Some fields are already overcrowded. By June the less popular fields should be affected by the large supply. Replacements are estimated at 2,000 annually.

Industrial engineers—The need to speed up production and lower costs will keep demand high as long as industrial activity is high. Many now doing industrial engineering work are not college graduates. Many of these will be replaced. If industrial activity stays high, industrial engineers will be in short supply for several more years.

Draftsmen—There is an oversupply of those without proper training. The demand for the well trained man is still high.

Construction electricians—The supply will depend a lot upon construction activity. There has been a shortage in the industrial field. As plant expansion catches up, there will be less demand. A successful Planned Lighting Program could keep employment high. The result would be a continued shortage.

Electronic technicians—In over supply.

Structural iron workers—Will stay in short supply as long as construction activity remains high.

Power linemen—The long-term expansion program of all electric suppliers plus the increased amount of maintenance necessary will keep linemen in short supply. Contributing to the shortage is the fact that elderly men are seldom suitable for continued pole-top work.

Office help—In ample supply with one exception, certified public accountants, who are in great demand because of complicated tax problems and a growing emphasis on scientific management.

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Ketchikan Will Improve Beaver Falls Pipeline

The Ketchikan, Alaska, Public Utilities Board has authorized development of plans for an improved or additional pipeline at its Beaver Falls hydroelectric plant. Rising consumption indicates the city will require a new source of power in about two years.

Defects in the present pipeline include two large sections of trestle work and two rises, where pressure is lost. Tunnels are being considered to eliminate the trestles and utilize the full head of water available. A new pipeline would involve a new generator.

ECA ADMINISTRATOR Paul Hoffman talks with European electric system operators at ECA headquarters in Washington. Europeans are touring the United States

Arkansas P&L Ordered to Serve Co-op Territory

Arkansas Public Service Commission has ordered the Arkansas Power & Light Co to serve an area in Calhoun County that previously had been allocated to the Ouachita Rural Electric Cooperative Corporation.

The order followed a visit to the Commission by a large delegation of residents in the area who filed both written and oral complaints against the co-op for not supplying them with service. They asked that AP&L be ordered to serve them.

At a hearing the Ouachita Rural Electric Co-op protested loss of the territory. Vice-President R. E. Ritchie of AP&L said his company was not seeking the territory and did not desire to take it from the co-op.

In its order, the Commission said that testimony of 25 witnesses was substantially alike on these points:

The area was allocated to the co-op before World War II, residents of the area have been treated discourteously on several occasions by officials of the co-op, all residents of the area prefer to be served by AP&L because they believe service will be better, many residents of the area are so hostile to the co-op they would refuse to grant easements to it, AP&L lines are now at the edge of the area, and the company could serve it economically and feasibly.

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Rate Injunction Granted

Florida Power Corp has been granted a temporary injunction by a Circuit Court permitting it to place in effect in DeLand an 8½% rate increase. A final decision on the increase is still to be made by the DeLand City Commission, which has been opposing it. The Commission has been slow in reaching a decision, and the utility argued that it had to get out its April bills before a number of visitors departed for the North.

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Iowa P&L Co Awarded Council Bluffs Franchise

Iowa Power & Light Co has been granted a 20-year franchise by the City Council of Council Bluffs, Iowa. The franchise will be submitted to the voters on May 10.

The utility entered into a contract with the Omaha Electric Committee on Dec 4, 1948, for the purchase of the Western Iowa Power Co. This company serves Council Bluffs, Glenwood, Treynor, and other communities in a three-county area. The company predicts conclusion of the contract by June 1 upon approval of the purchase by the Securities and Exchange Commission and upon Iowa Power's success in winning the Council Bluffs franchise.

The Iowa properties are a part of the old Nebraska Power Co, which because of their location in another state could not be taken over by the Omaha Public Power District.

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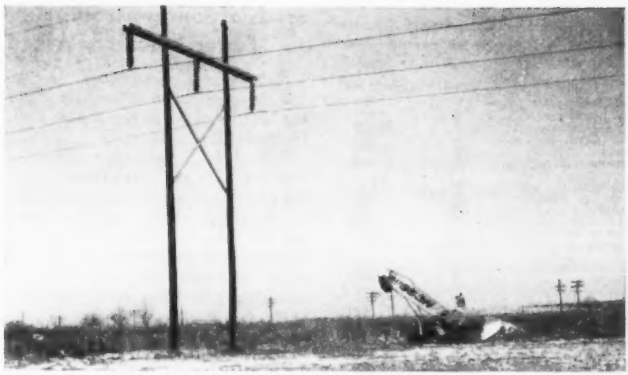
Strikers Penalized

The three members of the Operating Engineers Union, AFL, who took the Venice, Ill., plant of the Union Electric Co off the line on Mar 16 have been suspended 30 days without pay. The union agreed to the suspension because the action, taken in sympathy with a strike at a gas plant, was unauthorized.



SURPRISE AND UNDESIRED TEST proved the excellence of this 161-kv transmission line of the Kansas City Power & Light Co. The plane, out of control, dived between the shield wires and phase conductors, hooked a wheel on the center phase wire, and caught its tail under the overhead shield wire. In this position it slid along the wires for 40 to 50 ft before a wing sheared off. The plane fell to the ground, but the pilot escaped with a scratched nose. The transmission line was undamaged except for a broken insulator and burnishing of the 397,000 cir mil ACSR conductors

FCC Allocates 42 Short-Wave Radio Channels for Utilities Use

FEDERAL COMMUNICATIONS Commission announced its long-awaited permanent rules for general mobile radio services this week (May 3). The new rules, which become effective July 1, lump short-wave radio operations of electric, gas, water, and steam utilities into a new power radio service, a subdivision of FCC's Industrial Radio Service.

Power radio is assigned 42 frequencies for exclusive operations in three important bands. These include 11 exclusive frequencies in the 30-44 mc band, 22 in the 44-50 mc (former television) band, and nine in the 152-162 band. In addition, the service will share the 2292-kc frequency with other industrial services; 4637.5 kc in daytime only; and 35.06, 35.10, 35.14, and 35.18 mc. The latter four frequencies are to be shared with the maritime mobile service on a basis of no interference with the latter service.

For developmental use only, power radio will share 20 frequencies in the 456-458 mc bands and may share 2450-2500 mc, 3500-3700 mc, 6425-6575 mc, and 11700-12200 channels. Fixed stations in the power radio classification will share with other industrial stations 90 frequencies between 72.02 and 75.98 mc, provided they do not interfere with television on Channels 4 and 5. The fixed stations also may use wide ranges of the higher frequencies, between 952 and 30,000 mc for experimental purposes under developmental grants to be issued by FCC.

Present licensees in the utility radio service which has been abolished, may continue operations until their licenses expire, or until they request a modification. Their licenses then will be reclassified. Holders of Class 2 experimental service licenses must apply for their new classification no later than 60 days before their licenses expire, or by Nov 1, whichever is earlier. They may apply any time after July 1. All experimental grants in this group will expire Nov 1.

In addition to traditional electric, gas, water, and steam utilities, the new power utility radio service will include cooperative organizations. FCC's rules specifically establish the eligibility of co-ops. It is expected that REA-financed power systems will be the most important group of applicants in this classification.

FCC endorsed the operations of the National Committee for Utilities Radio as a "comprehensive national frequency assignment plan" which might offer a model for solution of frequency assignment problems of other industry groups.

Actual frequencies assigned for power utility radio base and mobile stations on an exclusive basis included the following:

37.46 mc—.50, .54, .58, .62, .66, .70, .74.
37.78 mc—.82, .86.
47.70 mc—.74, .78, .82, .86, .90, .94, .98.
48.02 mc—.06, .10, .14, .18, .22, .26, .30.
48.34 mc—.38, .42, .46, .50, .54.
153.41 mc—.47.
153.53 mc—.59, .65, .71.
158.13 mc—.19, .25.

Power radio service regulations also allow the establishment of non-profit corporations or associations to furnish short-wave communications service to utilities. Such organizations would be required to serve all utilities of a single area. It could obtain any of the frequencies available to a single utility under the power radio service. FCC would require a showing that the group operated on a non-profit basis.

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Atomic Labor Relations Panel is Set Up by AEC

A labor dispute at an electric power utility which serves a plant or facility engaged in atomic work may be handled by the new "Atomic Energy Labor Relations Panel" just established by the Atomic Energy Commission.

The panel, headed by former War Labor Board Chairman William H. Davis, will intervene if the dispute "threatens to interfere with an essential part of the atomic energy program."

Action by the panel would come only after collective bargaining and normal conciliation processes had been exhausted. The "status quo" would be maintained and there would be no strike or lockout until (1) an agreement was reached, (2) the panel terminated its jurisdiction, or (3) 30 days had elapsed after the panel issued recommendations.

While the panel will concern itself chiefly with contractors operating government-owned atomic installations for AEC, the panel and AEC are aware that a strike against a supplier of AEC contractors can be just as damaging, if not more so.

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New Contract Ups Wages

Wage increases averaging 5.75¢ an hour have been given some 900 employees in Virginia and West Virginia under terms of a new contract between Appalachian Electric Power Co and the International Brotherhood of Electrical Workers. Certain inequalities in some job classifications were adjusted, and agreement was reached on procedure for determining seniority.

Changes in Capacity Reported to Federal Power Commission

PLANT ADDITIONS DURING FEBRUARY

Utility	Plant	Fuel	Capacity (Kw)
Barton Electric Department	West Charleston, Vt.	H	700
Hartford (Conn.) Electric Light Co	South Meadow	S	1,000
Ohio Edison Co	Mad River	S	20,000
Hiram Municipal Light Department	Hiram, Ohio	IC	375
Toledo (Ohio) Edison Co	Acme	S	80,000
Toledo (Ohio) Edison Co	Edgewater	S	60,000
Freeburg Light Plant	Freeburg, Ill.	IC	970
O. & A. Electric Cooperative (Mich.)	Burnips	IC	380
O. & A. Electric Cooperative (Mich.)	Hershey	IC	1,146
Michigan Public Service Co	Baldwin	IC	330
Municipal Water & Light Department	Columbus, Ind.	IC	1,000
Rural Cooperative Power Association (Minn.)	Cambridge	IC	5,000
Border Counties Power Cooperative, Inc	Warroad, Minn.	IC	900
Border Counties Power Cooperative, Inc (Minn.)	Littlefork	IC	435
Iowa Power & Light Co	Oskaloosa	IC	3,480
Central States Electric Co	Belmond, Iowa	IC	2,300
Trenton Municipal Utilities	Trenton, Mo.	IC	1,056
Hastings Water & Light Department	Hastings, Neb.	S	6,000
Benkelman Light & Water Plant	Benkelman, Neb.	IC	448
Monongahela Power Co (W. Va.)	Willow Island	S	50,000
Rocky Mount Public Utilities	Rocky Mount, N. C.	S	15,000
Lake Worth Light & Water Department	Lake Worth, Fla.	IC	1,000
Florida Power & Light Co	Cutler	S	11,500
Tennessee Valley Authority	Fort Loudoun	H	32,000
Tennessee Valley Authority	Wheeler Dam	H	32,400
Okeene Light & Water Department	Okeene, Okla.	IC	590
Idaho Power Co	Lower Salmon	H	15,000
Pacific Gas & Electric Co (Calif.)	Station P	S	100,000
Los Angeles Department of Water & Power	Harbor	S	75,000

PLANT RETIREMENTS DURING FEBRUARY

Barton Electric Department	West Charleston, Vt.	H	325
Perth Amboy Electric Light Department	Perth Amboy, N. J.	IC	400
Freeburg Light Plant	Freeburg, Ill.	S	500
Wisconsin Power & Light Co	Pine River	H	100
Warroad Light & Power Department	Warroad, Minn.	IC	220
Border Counties Power Cooperative (Minn.)	Littlefork	IC	310
Sidney Public Utilities	Sidney, Neb.	S	175
Hastings Water & Light Department	Hastings, Neb.	S	1,000
Benkelman Light & Water Plant	Benkelman, Neb.	IC	75
Ashland Water & Light Department	Ashland, Ore.	IC	80
Henderson Electric Light Department	Henderson, Ky.	S	1,375
Tennessee Valley Authority	McMinnville	H	250
Tennessee Valley Authority	Shelbyville	H	432
Okeene Light & Water Department	Okeene, Okla.	IC	100
Western Colorado Power Co	Montrose	S	300

H—Hydro, IC—Internal Combustion, S—Steam.
United States Capacity as of Mar. 1—Steam, 39, 933,313 kw.; Internal Combustion, 1,632,709 kw; Hydro, 15,749,755 kw; Total, 57,315,777 kw.

Skagit PUD Will Spend $10 Million for 2 Plants

The Skagit County PUD, Mount Vernon, Wash., is planning to issue $10 million in bonds this year to finance construction of a 14,000-kw hydroelectric plant and a 10,000-kw steam plant.

The development is directed partly toward providing power for an extensive chromite operation at Anacortes by American Chrome & Magnesium Industries, Inc. Under consideration for later development is a 50,000-kw hydro project on Deer Creek in the Cascade Mountains.

The PUD also plans to obtain 10,000 kw of secondary power from the Bonneville Power Administration. The $3 million steam plant at Anacortes, would provide power when the Bonneville supply is unavailable. Designed to use either oil or pulverized coal, the steam plant is expected to be ready in about two years.

The hydro plant, on Illabot Creek in the Cascades about 40 miles east of Mount Vernon, would not be ready until three years after the start of construction this year. It would involve a low diversion dam and a 1,000-ft penstock, costing about $5 million.

Field studies are being conducted for the steam plant and will begin for the Illabot Creek project as soon as snow leaves the ground. In July the PUD hopes to call for bids on the bonds and perhaps also on some construction.

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Northwest Ban Asked on New Space Heating

A ban on "new or additional electric space heating installations and connections of industrial loads of 500 kw or more until the expiration of the present emergency with respect to the deficiency of electric power" has been recommended to power utilities of the Pacific Northwest by the Utilities Conference Committee of that area.

The committee's action had been under consideration since last winter, when the power shortage first became acute. Most utilities already have banned the additional use of electricity for space heating.

Study of Southwest Soil, Power Resources Asked

Stepped-up development of river resources in eight Southwestern states has been proposed by Sen Robert Kerr, Oklahoma Democrat.

Backed by a bipartisan group of Senators from the area, Senator Kerr has introduced legislation providing for a special study of the Southwest's water and soil resources. The study would be made by a commission of federal and state representatives. The objective would be preparation of a Southwest development program comparable to the Pick-Sloan plan for the Missouri Basin.

The study commission would look into present improvement work in the Arkansas-White and Red River Basins, suggest new or better projects, then report to Congress. Senator Kerr said he did not anticipate that any proposals for valley authority type development would be recommended by the commission. But the scope of the survey would include operation as well as construction of river projects.

Federal representatives would be selected by the President as follows: One each from the Agriculture and Interior Departments, from the Army Engineers and Federal Power Commission, and a chairman from the Southwest. The chairman would not be a federal employee. Each of the eight states—Missouri, Arkansas, Louisiana, Texas, Oklahoma, Kansas, Colorado, and New Mexico—also would select a member.

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Utility's Franchise Ruled Without Legal Time Limit

Birmingham Electric Co has a franchise to operate in Bessemer, Ala., without time limit, according to a ruling of the Alabama Supreme Court. The Court decided the State Constitution's 30-year limitation on franchises does not apply to the Bessemer case because the franchise there went into effect before the Constitution.

The city argued that the Constitution became effective Nov 11, 1901, and the utility franchise, the following day. The court held that the Constitution, while ratified on Nov 11, did not actually take effect until Nov 28, when Gov William D. Jelks proclaimed it.

The utility charter was granted originally to the Bessemer Electric Corp in April, 1890. On Nov 12, 1901, a city ordinance was passed transferring it to the Birmingham Railway, Light & Power Co, now Birmingham Electric.

AEC Reactor Testing Is Far Away, Says Hafstad

There's no hurry about manning and equipping the new nuclear reactor testing station in Idaho. The entire project hinges on research and development at other Atomic Energy Commission facilities—which first must produce reactors to test.

According to Dr Lawrence R. Hafstad, chief of AEC reactor development,

LEONARD E. JOHNSTON

no tests are likely at the new station in the near future. Eventually, several types of reactors, now in various stages of planning or development, are scheduled for trials at the Idaho site. Dr. Hafstad made it plain, however, that the tests are years, rather than months, in the future.

AEC is negotiating with the Navy for the 173,000-acre Arco proving grounds, which the Commission plans to incorporate in the 400,000-acre test area. Unlike Hanford, Oak Ridge, and other AEC installations, the Idaho facility will take shape gradually. No community will be built. Operating personnel are expected to obtain housing in existing communities in the area. The only construction likely this year, Dr Hafstad reported, may be installation of a water supply system and other utilities.

Leonard E. Johnston, manager of the Knolls Laboratory at Schenectady, has been appointed manager of the new test station. Until his successor at Knolls has been named, Johnston will direct both facilities from AEC headquarters in Washington, D. C.

A native of South Dakota, Johnston received an electrical engineering degree from South Dakota State College in 1933. From 1934 to 1942 he served as a civilian engineer at the Army Engineers' Fort Peck, Mont., project. Assigned to Oak Ridge in 1944, he was construction officer for the electromagnetic plant that produced U-235 there during the war. In June, 1946, he opened AEC's Schenectady office when the Knolls Laboratory was started with General Electric as the operating contractor.

•

Pinellas Board Given Supreme Court Approval

The Florida Power Corp has lost its suit to deprive the Pinellas County Utility Board of its powers over rates of electric and gas utilities. The Florida Supreme Court in a 5 to 2 decision upheld the lower courts' decision that the county had the power and authority to spend taxpayers' money for the control of public utilities.

Behind the fight of the utility was the odd situation in Florida. The state is one of the few which exercises no state control over utilities. The Pineallas Board was looked upon as the first of many county boards. Since the utility operates in many counties, it anticipates many complications if other counties establish similar bodies. Legislation has been introduced in the Florida Legislature to provide for state control. But this has not yet been approved.

The utility still has the right to petition for a new hearing.

•

Pay Rise Ends Strike

After 16 days, the strike of employees of the South Carolina Electric & Gas Co ended (Apr 26) with the signing of a contract granting a pay increase of 10%. The employees are represented by the International Brotherhood of Electrical Workers, AFL. The settlement was a compromise. The union had asked a 14% increase; the company had offered 7%. During the strike supervisory employees maintained electric and gas service.

•

Randolph Named to PSC

John P. Randolph, St. Joseph, Mo., has been appointed to the Missouri Public Service Commission. His six-year term will expire Apr 15, 1955. E. L. McClintook, Cape Girardeau, was reappointed for six years.

•

Utilities Bills Taxed

Edgewater, Daytona Beach, and Port Orange, Fla., all have passed or are acting on ordinances to tax utilities bills 10%.

Ingraham Gets McGraw Wholesalers Medal for '48

Edgar B. Ingraham, president of the National Electrical Wholesalers Association, has been awarded the James H. McGraw Award Wholesalers Medal for 1948. Presentation was made this week (May 4) at the annual convention of the National Electrical Wholesalers Association at Cincinnati.

Ingraham received the award "for his

EDGAR B. INGRAHAM

inspiring leadership of his industry in forming and developing the Appliance Division of the National Electrical Wholesalers Association and his vigorous efforts to advance the economic position of the electrical wholesaler."

Judges who made the selection were Herbert Metz, Graybar Electric Co, New York; F. R. Eiseman, Revere Electric Supply Co, Chicago; John M. Newton, Oakes Electrical Supply Co, Holyoke, Mass.; D. M. Salsbury, Westinghouse Electric Supply Co, New York; and William T. Stuart, editor of *Electrical Construction and Maintenance* and secretary of the Committee of Awards.

•

Intermittent Radio Alarm System Installed by Utility

Montana Power Co has received a Federal Communications Commission license to operate a unique radio alarm system with a transmission period limited to one minute. In case of alarm at one of 15 transmitters, an identifying coded signal is sent to the single recording receiver. A small motor turns a disk that sends the coded signal and cuts it off after 60 seconds.

Transmitters rated at ½-w output will operate at 75.5 megacycles up to a maximum of 15 miles with directional antennas. Signals will be amplitude-modulated at 2,430 cycles to forestall interference with any future similar systems.

Tacoma Considers Suit Over Cowlitz River Dams

Tacoma is considering court action to invalidate a new Washington law that blocks the city from constructing two hydroelectric dams on the Cowlitz River.

The action would be based upon a federal court decision in Iowa that when the federal government has assumed jurisdiction over a stream, a state cannot affect proceedings. Federal jurisdiction over the Cowlitz would be based on Tacoma's application to the Federal Power Commission for permission to construct the dams.

If it can't build on the Cowlitz, Tacoma would like to buy two Puget Sound Power & Light Co. generating plants near the city but the power company doesn't want to sell and two PUDs have filed condemnation suits against the plants. Seattle also would like to buy one of the plants, on the White River, with a capacity of 63,000 kw.

•

PUD Retirement Fund Held Illegal by Examiner

A retirement plan for employees of the Clark County (Wash.) PUD has been abandoned as a result of a directive from J. R. Bowen, state examiner who is auditing the district's books. The directive cited an opinion by the state attorney general holding it illegal for public utility districts to contribute to retirement funds.

The retirement fund was established in February, 1948, through an agreement between the PUD and the office workers and electrical workers unions. Under this agreement the PUD matched funds contributed by employees.

V. M. Cleaveland, PUD manager, said the $9,700 which the district has paid into the retirement fund would be transferred to the general revenue fund.

•

Home Ec Booklet Issued

A booklet to be used by electric utility companies in recruiting trained home economics personnel has just been released by the Edison Electric Institute. Entitled "Make Home Economics Your Profession," the eight-page, two-color booklet is designed to encourage high school students to study home economics in college. It outlines the opportunities open to home economists in many fields. The booklet is available for a small charge from the Institute, 420 Lexington Ave, New York 17, N. Y.

SEC RULINGS

United Light & Railways Co has advised SEC that it has sold to its stockholders all but 6,673 shares of the 634,667 shares of its holdings of 1,268,698 shares of the common stock ($25 par) of American Light & Traction Co, offered at $25 per share. Both companies are located in Chicago. United was authorized to sell the remaining shares through ordinary brokerage transactions on the New York Curb Exchange and to distribute to the stockholders entitled thereto the net proceeds of such sale. (Release No. 8955).

Mississippi Power Co. Gulfport, has received authorization to sell $2,000,000 of 30-year first mortgage bonds, subject to the results of competitive bidding. The commission also authorized the sale of 100,000 additional shares of Mississippi's stock to its parent, The Southern Co, for $2,000,000. Proceeds of the financing would be used to provide a portion of the funds needed by Mississippi for construction purposes. (Release No. 8949).

Philadelphia Co's plan for corporate simplification moved forward with the issuance of an opinion denying a motion to consolidate the proceedings on the plan on which hearings commenced last month with proceedings pertaining to that company's parent, Standard Gas & Electric Co. The motion also sought to enlarge the scope of the present proceedings so as to permit consideration of plans for reorganization of Philadelphia or Standard Gas which might be submitted by the commission or any interested person. This, too, was denied by the commission. The motion had been filed by the protective committee for Standard Gas & Electric Co prior preference stock, $7 and $6 cumulative. It was denied by the commission "without prejudice to its possible renewal at some later date." According to the commission, "injection at this time of the issues in the Standard Gas reorganization into the Philadelphia Co situation would complicate rather than expedite the consummation of an appropriate plan for the latter company." (Release No. 8977).

Staten Island (N. Y.) Edison Corp has been permitted to issue and sell $1,750,000 of 2% notes to three commercial banks, proceeds of which would be used to meet the maturity of an equal amount of notes now outstanding. (Release No. 8964).

New England Electric System has received authorization to reduce the par value of its authorized and outstanding common shares from 7,500,000 to 8,500,000. NEES also will increase the authorized common shares from 7,500,000 to 8,500,000. Both proposals are subject to stockholder approval and will be voted upon at a meeting scheduled for May 17. (Release No. 9005).

United Light & Railways Co has received authorization to distribute to its common stockholders 132,991 shares of the common stock of Madison Gas & Electric Co. The distribution will be at the rate of one share of Madison stock for each 25 shares of Railways common stock owned. Madison shares not required for such distribution are to be sold. Cash is to be paid out in lieu of the distribution of fractional shares. (Release No. 9006).

MEETINGS

Edison Electric Institute
Purchasing and Stores Committee, Jefferson Hotel, St. Louis, May 9-11; Commercial Electric Cooking Conference, Madison Hotel, Atlantic City, May 25; Annual Meeting, Traymore Hotel, Atlantic City, May 31-June 2; Hydraulic Power Committee, Shirley Savoy Hotel, Denver, Colo., June 22-25.

Northwest Electric Light & Power Association
Business Development Section, Hotel Utah, Salt Lake City, May 9-11; Personnel Section, Benjamin Franklin Hotel, Seattle, Wash., May 25-27; Accounting & Business Practice Section, Vancouver Hotel, Vancouver, B. C., June 23-24.

American Public Power Association
Annual Convention, Ambassador Hotel, Los Angeles, Calif., May 10-12.

Pennsylvania Electric Association
Transmission and Distribution Committee, Irem Temple Country Club, Dallas, Pa., May 12-13; Spring Meeting, Meter Committee, Abraham Lincoln Hotel, Reading, Pa., May 19-20; Rural and Advertising Committees, Joint Meeting, State College, Pa., June 8-9.

Instrument Society of America
Spring Meeting, Royal York Hotel, Toronto, Canada, May 12-13.

Interstate Power Club of New York
May Meeting, Hotel Martinique, New York, May 16.

National Fire Protection Association
Annual Meeting, Fairmont Hotel, San Francisco, Calif., May 16-19.

Missouri Valley Electrical Association
Annual Meeting, Hotel President, Kansas City, Mo., May 17.

★American Standards Association
Company Member Conference, Benjamin Franklin Hotel, Philadelphia, Pa., May 19-20.

New Jersey Utilities Association
Spring Meeting, Seaview Country Club, Absecon, N. J., May 20.

Pacific Coast Electrical Association
Annual Meeting, Coronado Hotel, San Diego, Calif., May 25-27.

★Canadian International Trade Fair
Exhibition Grounds, Toronto, Ont., May 30-June 10.

Conference on Protective Relaying
Under Auspices of Georgia Tech Engineering Extension Division, Georgia Institute of Technology, Atlanta, Ga., June 16-17.

Public Utilities Advertising Association
Annual Meeting, Netherland Plaza Hotel, Cincinnati, Ohio, June 20-21.

American Institute of Electrical Engineers
Summer General Meeting, New Ocean House, Swampscott, Mass., June 20-24; Pacific General Meeting, Fairmont Hotel, San Francisco, Calif., August 23-26.

American Society for Engineering Education
Annual Convention, Rensselaer Polytechnic Institute, Troy, N. Y., June 20-24.

American Society for Testing Materials
Annual Meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 27-July 1.

Canadian Electrical Association
Annual Meeting, Banff Springs Hotel, Banff, Alberta, Canada, June 28-30.

★ Additions this week.

Army-Reclamation Fight Ups Costs of U. S. Jobs

Wasteful competition between the Army Engineers and the Bureau of Reclamation has resulted in extremely high costs on federal projects, Leslie A. Miller, former governor of Wyoming, told the spring conference of the Rocky Mountain Electrical League last week at Cheyenne. He cited as just one example a dam in Wyoming, which finally cost the government three times the normal cost per kw of installed capacity.

Importance of preventive maintenance in utility operations was emphasized in a paper by H. B. Colby, Public Service Co of Colorado. He said that study of equipment failure records indicates persistent preventive maintenance can reduce substantially the electrical utilities' maintenance bill, which will be $313 million in 1949.

Significant developments in new electronic tools available to electric utilities, including new carrier current equipment, selective signal'ing, and fault locaters were described by J. C. Livesay, Colorado Central Power Co.

The meeting concluded with a panel discussion of industry problems, led by G. B. Buck, Public Service Co of Colorado. Questions on training programs, space heating, televi-sion, and other subjects were answered by top men of the electrical industry.

•

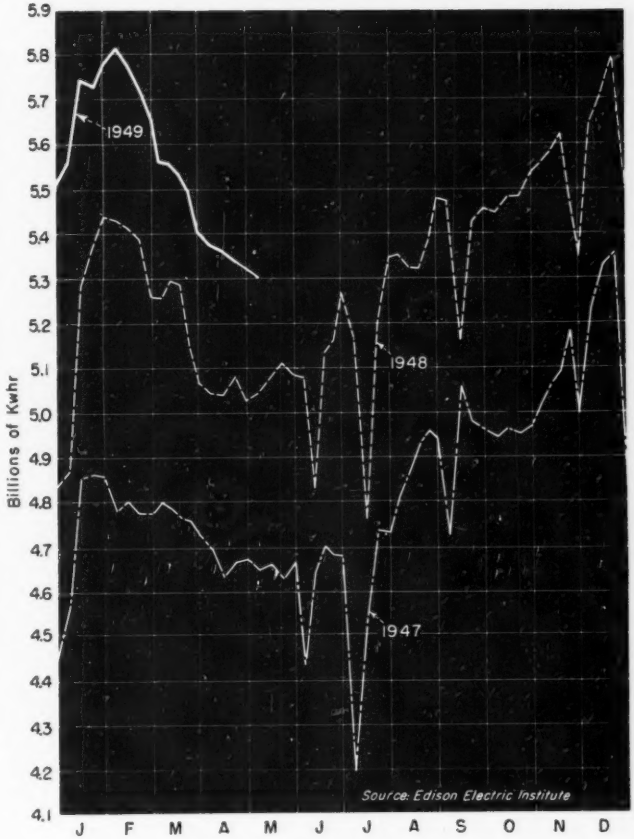
Christoffel Gets Review

The U. S. Supreme Court has agreed to review the conviction of Harold R. Christoffel, former president of Local 248, UAW-CIO, on a charge of perjury. He is under sentence of two to six years. His conviction grew out of an appearance before the House Labor Committee in March, 1947, when he testified that he had never been a Communist. Later testimony disproved this. The local at the time was conducting a strike against the Allis-Chalmers Manufacturing Co.

•

Harold Kramer Dies

Harold Kramer, general manager of the Loup River Public Power District in Nebraska, died of a heart attack on Apr 29 in Durham, N. C. Widely known in public power circles, Mr Kramer was one of the organizers of the American Public Power Association in Washington. He was born in Columbus, Neb., and was a business man before helping to organize the Loup River agency in 1932.



Output Continues to Drop

No reversal halted the downward trend in electric output during the week ended Apr 30, 1949, according to figures released by the Edison Electric Institute. Continuing to move downward, the total amount of electrical energy distributed by the electric light and power companies of the country dropped to 5,303,841,000 kwhr, comparing with 5,325,513,000 kwhr for the preceding week.

During the corresponding week last year, ended on May 1, the total output totaled 5,042,352,000 kwhr, this year's figure representing an increase of 5.2%. This percent change was a slight decrease under that reported for the week ended Apr 23, when a 5.9% increase was shown.

Both the New England and the Mid-Atlantic States remained in the minus column, the former with a drop of 1.6%, which was a decrease from 2.2% for the preceding week; the latter with an 0.9% decrease, against 0.6% the preceding week.

The largest individual increase was again reported by the Pacific States, 12.1%.

Weekly Output, Millions Kwhr

1949	1948	1947
Apr 30 5,304	May 1 5,042	May 3 4,640
Apr 23 5,326	Apr 24 5,027	Apr 26 4,668
Apr 16 5,343	Apr 17 5,087	Apr 19 4,660
Apr 9 5,360	Apr 10 5,033	Apr 12 4,620
Apr 2 5,378	Apr 3 5,037	Apr 5 4,693
Mar 26 5,404	Mar 27 5,065	Mar 29 4,729
Mar 19 5,496	Mar 20 5,145	Mar 22 4,759
Mar 12 5,531	Mar 13 5,285	Mar 15 4,764
Mar 5 5,552	Mar 6 5,293	Mar 8 4,787
Feb 26 5,559	Feb 28 5,252	Mar 1 4,797
Feb 19 5,650	Feb 21 5,254	Feb 22 4,778
Feb 12 5,722	Feb 14 5,385	Feb 15 4,778
Feb 5 5,778	Feb 7 5,412	Feb 8 4,801

Percent Change from Previous Year

	Apr 30	Apr 23	Apr 16
New England	— 1.6	— 2.2	— 3.8
Mid-Atlantic	— 0.9	— 0.6	— 2.3
Central Industrial	+ 3.9	+ 6.3	+ 4.5
West Central	+ 8.4	+11.0	+10.4
Southeast	+ 7.2	+ 8.9	+ 8.9
South Central	+ 7.7	+ 5.0	+ 6.7
Rocky Mountain	+11.7	+ 8.8	+12.1
Pacific Coast	+12.1	+11.7	+11.0
Total United States	+ 5.2	+ 5.9	+ 5.0

WASHINGTON COMMENT

WILLIAM B. WHICHARD

FEDERAL POWER COMMISSION has just staged the second performance of its apparently perennial "show" on proposed revision of the Natural Gas Act. As usual, the theatrics, including an exhibition of plain and fancy doubletalk, were put on for the benefit of Congress—before a House committee, this time. The net results seem to have been the complete befuddlement of several Congressmen, frustration of the natural gas industry, and burial of the proposed amendments.

In case anyone came in late, FPC has been putting on virtually the same show for the past two years, but with some significant changes in the lines and roles of some of the Commission's performers. It was in the Republican 80th Congress that the first serious efforts were made to amend the Natural Gas Act. Then, as now, a principal criticism of the statute and FPC's administration of it was the alleged failure to insure the exemption of independent producers of gas from federal regulation. Hitherto, the industry felt that the Act itself specifically exempted independent (non-pipe-line) production of gas. But FPC, particularly in an action to regulate the Interstate Natural Gas Co's sales to pipe lines, seemed to be moving closer to well-head regulation of gas destined to move interstate. When the Supreme Court upheld FPC, in the Interstate case, independents became alarmed.

And well they might. Interstate pipe lines are the major outlets for some 2,300 independent producers.

At any rate, FPC pooh-poohed the fears of such an extension of is regulatory field. In fact, it formally adopted an order—No. 139—in August, 1947, declaring the Commission would not exercise jursidiction over arm's-length sales of gas by independent producers or gathers to pipe line companies. Commissioner Olds, now the dominant member of the Commission but enjoying lesser status in those days, endorsed Order No. 139. He also joined two other Commissioners in assuring Congress that FPC wouldn't regulate the independent producers. FPC probably lacked jurisdiction, Olds said then.

But two important events have occurred since 1947. First, the Gas Act amendments died in the Senate after a bitter controversy. And, shortly thereafter, a new Democratic Congress was elected.

These events may or may not have influenced the regulatory ponderings of Commissioner Olds. Certainly something has affected his thinking, since it has taken a directly opposite turn.

When new Gas Act amendments were introduced this year in Congress, the sponsors of the most serious bills directed their attention to preventing federal regulation of independent production and gathering. All members of FPC opposed these bills on grounds they would go beyond this intent. But the Olds-Buchanan-Draper majority of FPC challenged the advisability of limiting the Commission's authority to this extent. Apparently, Olds no longer had any doubt as to FPC's jurisdiction.

As spokesman for the majority, Olds asserted that he had erred in agreeing to Order No. 139. FPC, he added, must regulate sales by independents to pipe lines if "any producers attempt to . . . charge all that the traffic will bear." Producers' prices, at the moment, appeared to be "reasonable," he said, so regulation is not imminent.

Not imminent, that is, unless Commissioner Olds changes his mind again. This leaves the industry up in the air. Did anyone plan it that way?

TECHNICAL NOTES

ARCHER E. KNOWLTON

Auxiliary motors, connected up when one plant was at the startingup stage, ran backwards to the extent of 60%. Standardization could make such experience negligibly small.

Wire burn-downs have been found due to inadequate clearance of arresters, cutouts and crossover leads from phase wires. Moral: inspect to insure conformity with construction standards.

Transmission has been knocked out by glaze whereas distribution was not affected because the air was a few degrees warmer near the ground.

Crossarms doubled flat on the same side of the pole are stronger, according to tests, than two on opposite sides of the pole with spacer blocks.

Television image size varies with the applied voltage because the sweep circuits respond proportionately.

Distribution philosphy may have to change more or less violently if the prophesied loads and load densities materialize.

Meter departments as well as distribution departments have special requirements for trucks and these should be made known to and respected by the purchasing agents.

Metallic strip for stamped meter numbering should carry a non-fading enamel that will not peel when the embossed areas are burnished off for contrast.

Arc-tracking in terminal blocks is something for which materials only with difficulty have merit. The melamines will probably be advantageous whenever they can be substituted.

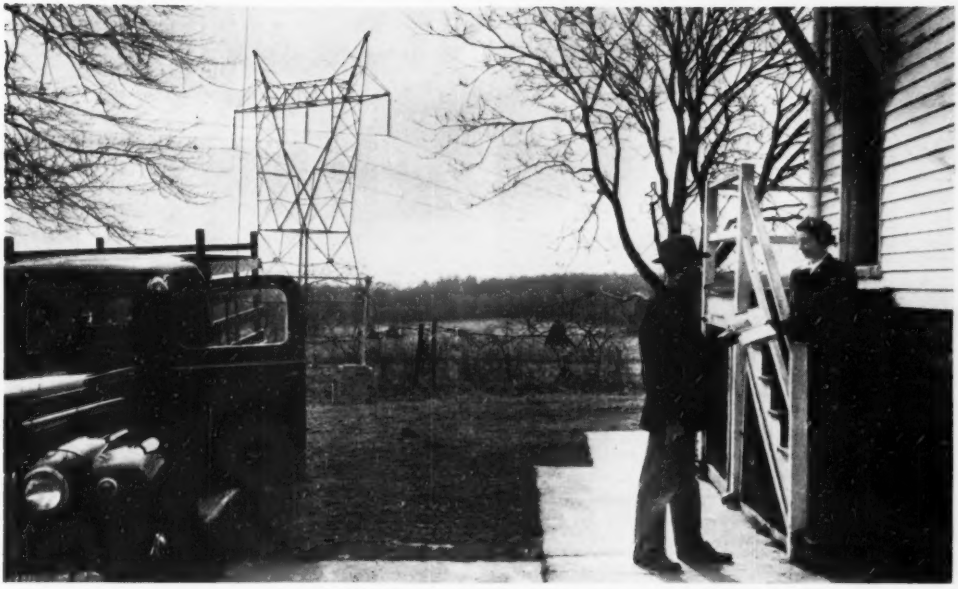


FIG 1—NEIGHBORS living along transmission lines help patrolmen by reporting unusual conditions that might jeopardize service. Patrolmen, above drops in to leave new company calendar that tells what to watch for and lists emergency phone numbers.

We Make Friends of Our Neighbors

Pennsylvania utility goes all out to make friends of its neighbors along transmission lines and near generating plants. Neighbors cooperate by reporting conditions along transmission lines. Company installs facilities for fishermen at hydro plants, encourages plant visits.

R. L. BORTNER
Vice President
Pennsylvania Water & Power Co
Baltimore, Md.

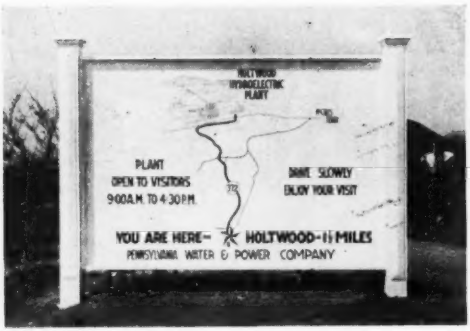
MOST NEIGHBORS fall into two general groups. There is the kind who lives close to you but knows little about you except your name; he takes no interest in what you do for a living or what your problems are. Then there is the friendly neighbor who not only knows your name, but what you do for a living, what problems you face, and a great many other things. It is he who, in times of trouble is ready to offer a helping hand.

We feel that we need friendly neighbors who know what we have done in the past and what we hope to do in the future. One way to have the public understand our industry is to see that our neighbors become our friends, because we are in a position to see that they learn about our business from those in whom they have confidence.

It is on this conviction that the public relations program of our company is founded.

Only Five Customers

The position of Pennsylvania Water & Power Co and its sister company, Safe Harbor Water Power Corp is somewhat different from other operating companies. We have only five customers. They are other utilities that are served by 536 circuit miles of transmission lines. Penn Water owns and operates a hydroelectric plant at Holtwood, Pa. having an installed capacity of 144,500 hp and a steam electric plant having an installed capacity of 40,000 hp. Safe Harbor Water Power Corp owns and operates a hydroelectric plant with an installed capacity of 297,500 hp at Safe Harbor, 8 miles north of Holtwood. There two hydro plants and the steam plant are interconnected through transmission lines with utility companies operating in Maryland, Washington, D. C., and southeastern Pennsylvania. Other high tension lines serve the Pennsylvania Railroad at several points.


HOLTWOOD HYDROELECTRIC PLANT
PLANT OPEN TO VISITORS 9:00 A.M. TO 4:30 P.M.
DRIVE SLOWLY ENJOY YOUR VISIT
YOU ARE HERE
HOLTWOOD-11 MILES
PENNSYLVANIA WATER & POWER COMPANY

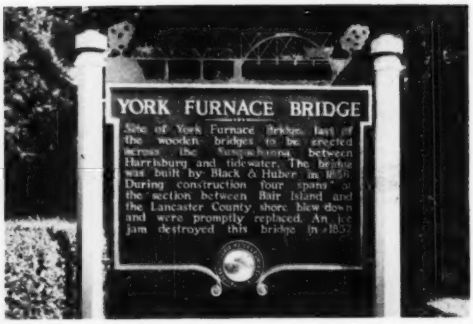

YORK FURNACE BRIDGE
Site of York Furnace Bridge, last of the wooden bridges to be erected across the Susquehanna between Harrisburg and tidewater. The bridge was built by Black & Huber in 1858. During construction four spans of the section between Bair Island and the Lancaster County shore blew down and were promptly replaced. An ice jam destroyed this bridge in 1865.

FIG 2 & 3—SIGNS erected by company direct visitors to plants and mark historical points of interest in the surrounding territory

Before World War II we had no planned public relations program. Whenever people asked to inspect our plants we provided a guide, but we took no steps to let the public know that visitors were welcome. We had no effective literature or information available for them. While our employees were encouraged to take part in civic and community affairs and to join professional and technical associations, no effort was made to acquaint them with company problems and policies. However, as government competition and our own regulatory and other problems increased, we realized that it was essential that our employees should know of the situation and that the public, too, should be informed.

We Got Acquainted

Our present public relations program stems from an experiment started among our neighbors; those people who lived along our transmission lines. Because the nature of our business makes reliability of service extremely important, we have patrolmen living at patrol stations 14 miles apart on each transmission line. Their duties are not only inspection and maintenance, but the reporting of sleet or other hazardous conditions. These patrolmen are encouraged to become acquainted with the people living adjacent to the transmission lines. To supplement the occasional contacts between the patrol staff and the residents we asked our Assistant System Chief Operator early in the program to visit individuals living close to the lines, in company with the section patrolman. During such visits they explained that they were asking the cooperation of the property owner in reporting sleet or other abnormal weather or transmission line conditions. Arrangements were made to pay for any services he rendered.

They Helped Us

Out of these visits grew a plan whereby each person living along our lines helps us keep our lines trouble free. Each of these neighbors receives a calendar containing on the front a picture of one of our transmission towers and a message explaining that the line is owned and operated by Pennsylvania Water & Power Co. that it is important to keep it in service at all times, and asking that he report any unusual conditions such as sparks or flashes of fire along the cables, a cable hanging below its usual position, kite strings or pieces of wire hanging on the cables, or serious brush or wood fires on or near the right of way. The last page of the calendar lists the name of the section patrolman and his telephone number, telephone numbers of the operators at the hydro stations and the Load Dispatcher's Office in Baltimore as well as other information as to where calls may be made in an emergency. These calendars are handed directly to our neighbors each year by a representative of the company, who again invites each neighbor to visit our plants when he has an opportunity.

This program has been a success. We receive many telephone calls from our transmission line neighbors when an unusual condition arises. Furthermore, when this program started we found that some of our neighbors were resentful because of incidents that had happened when rights of way were acquired. We have been able to discuss these matters and to turn potential enemies into friends by clarifying the company's position.

We Invite Them Over

The success of our transmission line program convinced us that a similar program would be successful if applied to neighbors living in communities near our plants. Of course it was not practicable to call on them, but we felt that many persons would be interested in visiting our plants. In this way they would have personal contact with our employees and an opportunity to see for themselves the efficient job being done.

First step in this program was to develop a road map which not only shows highways leading to our plants from Baltimore, Philadelphia, Harrisburg, Lancaster and York but calls attention to interesting historical locations in the area. The map folder carries a brief description of the Holtwood and Safe Harbor plants, and the recreational facilities afforded by the lakes. There is a description of a museum located along the shores of one of the lakes, and other interesting information. These map folders were placed in hotels, service stations, restaurants, and other public places in an area extending from Baltimore and Washington to Gettysburg, Harrisburg, Reading, and Philadelphia. Copies have been distributed through automobile clubs, and sent to school teachers and others who requested them for educational,

historical, or other similar purposes.

During 1948 we registered 15,742 visitors at our plants, which are open for inspection from 9:00 A.M. to 4:30 P.M. daily. All such visitors are directed to a visitors' lobby where they are formed into groups by an employee of the company. After "briefing" the visitors on the location and characteristics of Holtwood and Safe Harbor, the guide escorts them through the plant to see at first hand how it operates and the efficient manner in which it is maintained. Visitors are at liberty to spend as much time as desired asking questions or looking at equipment. Every effort is made to see that they are not hurried through the plant or made to feel that they are anything but welcome. Before leaving, our guests are given literature describing the plants and their operation. A new booklet entitled "Hydroelectric Power Development of the Susquehanna River," has been published for this purpose.

The strongest point in our program is the personal contact between our employees and the persons who visit our plants. Employees generally, and the guards and guides, in particular, are taking a real interest in our plan. Many excellent suggestions are received from them. We, in turn, try to keep them informed through the medium of supervisors' meetings, public relations news letters, and other informative material such as a year-end summary of ECAP advertisements bound in booklet form.

Fishermen Welcome

The Susquehanna River in the vicinity of Holtwood and Safe Harbor has always been considered a good fishing area for walleyed pike, bass, catfish, and other fresh water species. The agitation of the water in the tailrace attracts fish. To accommodate the fishermen at Safe Harbor fishing is permitted from the draft tube bridge. This is not practical at Holtwood because of the arrangement of electrical equipment, but we do permit fishing from the company grounds along one side of the tailrace.

Before the last war thousands of fishermen visited these areas each year but we had no rules or regulations governing fishing. This sometimes created problems for our operating department, one serious one being the expense of cleaning up and removing debris left on company property. Last year, to correct these conditions, representatives of the Federated Sportsmen's Clubs in nearby Lancaster and York were called into consultation and a fishing club was formed known as the Hydro Fishing Club. This club has no officers and the members pay no dues. After an application submitted to one of the Federated Sportsmen's Clubs is approved and forwarded to us we issue a badge containing a membership number, and the recipient becomes a full member. This badge eliminates the necessity of registering at the gate and, in addition, all members of the Hydro Fishing Club are eligible for prizes which are awarded under certain fishing contest rules for first, second, and third prizes for four different species of fish. In 1948 the total prizes awarded by the company amounted to $200.

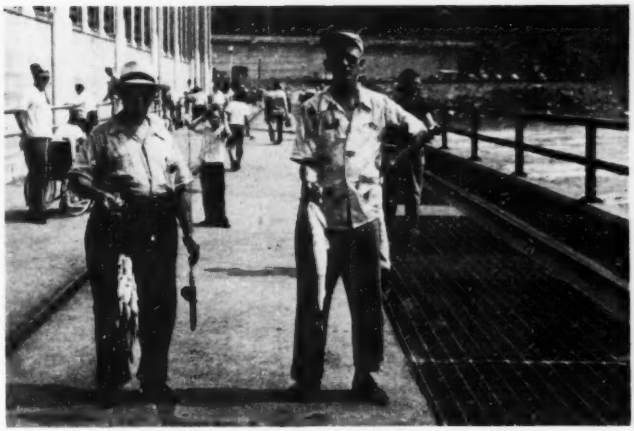


FIG 4—FISHERMEN are welcome at hydro plants where facilities have been installed for their comfort and a fishing club organized by the company. These men have been fishing from the draft tube bridge at Safe Harbor.

The fishing club now has 768 members and to each one we recently sent a letter to tell about the results of the 1948 contest and our plans for the future. The return postcard that was enclosed for name and address changes, invited comments and suggestions and offered a copy of the company's booklet "Hydroelectric Power Development of the Susquehanna River." The response was very gratifying; more than 300 replies were received and all requested booklets. More than 95% of the comments were favorable—"Orchids to P.W.&P. Co. for what they are doing for the angler"—"You have created a lot of good will between P.W.&P. Co. and fishermen"—and all suggestions were constructive.

The problem of cleaning up has been eliminated as the fishermen now realize our desire to cooperate with them and are taking care of the companies' property. For our part, lighting facilities we have installed at both plants permit fishermen to fish at night, and by next summer special toilet facilities and shelters will be provided for them. In 1948 more than 22,000 fishermen were registered at the two plants, many of them from points as far away as Reading —about 50 miles distant.

So far this year 1,780 have joined the fishing club and applications are coming in at the rate of 100 a week. Plant visitors are in excess of the number registered this time last year. On the Sunday before Easter 538 visitors were at the two plants.

Erect Historical Markers

Within the last year Pennsylvania Water & Power Co purchased and erected fifteen historical road markers which have attracted much favorable attention. No solicitation to visit the plants is attached to these signs, but the company name and

FIG 5—HOLTWOOD HYDRO and steam station are the Mecca of thousands of visitors and fishermen each year

seal are placed on each. At the time of the erection of these signs a story was carried in the newspapers, and a radio commentator speaking over one of the Lancaster stations described them and their location, calling attention to the company's public spirit.

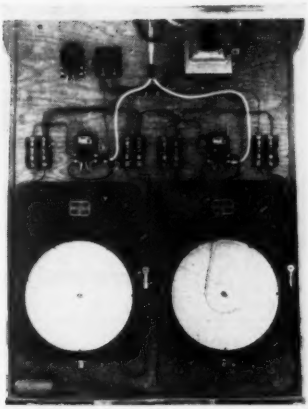
Some years ago in connection with the purchase of flowage basin property the company acquired a stone building known as Indian Steps Cabin, which had been built by the previous owner as a memorial to the Indians who formerly lived in that area. Realizing the importance of maintaining this building for the benefit of the public, we entered into an agreement with The Conservation Society of York County, which now operates it as a museum for the display of Indian relics. A bronze plaque set in the wall of the building at the time of its dedication as a museum in 1936 tells of the company's ownership and its cooperation with The Conservation Society of York County.

This company property is used frequently as a picnic ground by public school groups, by Sunday schools, and by others.

Close by the Holtwood and Safe Harbor plants the companies have made available to their employees recreation grounds where, in addition to adequate shelters, water, and toilet facilities, there are baseball diamonds, picnic groves, and tennis courts. These recreation areas are operated and controlled by employee groups known as the Holtwood Club and the Safe Harbor Hydro Club, but are frequently used, with permission, by churches, schools, families, industries, and private groups for picnics, games or other forms of recreation. In 1948 the Holtwood Club and Safe Harbor Hydro Club registered totals of 4,746 and 3,204 persons, respectively, but it should be noted that some of these registrants were company employees who were members of, or had some connection with, the groups using the property. At Holtwood, where the members of the Holtwood Club take great interest in an adult baseball team and a "midget" team (both entered in county leagues), 3,100 people attended the home games. Within sight of both these recreation areas are signs inviting people to visit the companies' hydro plants.

Although our present program of achieving good public relations through personal contact is paying dividends, it is somewhat difficult to evaluate its ultimate effect as we have not made any poll of visitors. However, occasionally our staff has had personal interviews with people visiting the plants and we have questioned the guides who have conducted the visitors through them. On the basis of the information thus secured we are convinced that the people who visit us leave with a friendly feeling toward the company and its employees. In several cases the writer personally interviewed visitors and found that they were impressed by the magnitude of the plants, the complexity of the equipment, and the friendliness of the employees, but that they did not understand that utilities such as ours are regulated as to earnings and that government competition and socialization of the industry masquerades as "public ownership." Our experience indicates that our neighbors, as individuals, are strongly in favor of the American system of free enterprise but that they are not aware of the threat to the system now arising from existing and proposed subsidized competition. It's our job to see that they are fully informed.

EFFECTIVENESS of technique is demonstrated by comparison test in which heating elements in one lane were energized and in other lane, were not



EACH TYPE of road surface has an individual recording meter and control system actuated by thermocouples in roadway

Ice on Highways Prevented By Electric Heat

HAROLD F. WALL
Assistant General Superintendent
City of Detroit Public Lighting Commission

RADIANT HEATING was used experimentally last winter to keep two test sections of highway free of ice and snow. Heat was supplied at the rate of 50 w per sq ft and indications on continuing experiments are that it will be successful and economical. Maximum demand, by test, was 175 kw for the 3,000 sq ft of total surface.

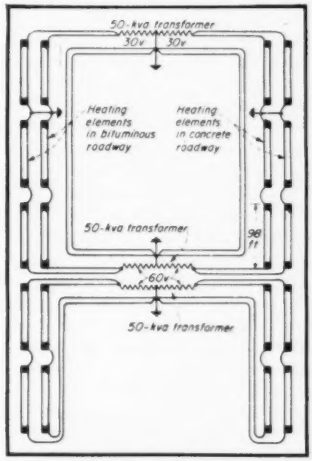
To determine the performance in both bituminous and concrete pavements, one 500-ft test installation was made in each. Each installation uses heating elements consisting of a 98 ft length of 2x2-in. mesh No. 14 gage galvanized iron wire fabric, 18-in. wide. Two heating elements are placed in the pavement approximately 3 ft 3 in. apart to provide an 18-in. wide ribbon of ice-free and snow-free pavement under each tread. At the ends of each element, a ¼x2-in. copper bar and terminal wires were brazed to permit power connections. For each 98-ft x 1.5-ft grid the resistance is 0.14 ohm, current is 245 amp.

In the concrete road, the heating elements were placed 2 in. below the surface; in the asphalt, 1½-in. To eliminate any possibility of shock to persons or animals coming in contact with the wet pavement, the heating elements were dipped in insulating varnish before installation and the circuits were energized at about 60 v. Both sides of the roadway are at the same potential and the drop along the roadway is 0.3 v per ft.

Control system consists of two recording temperature controllers, one for each type of surface, and associated relaying. These controllers are operated by bulbs placed in the pavement half way between the heating element and the pavement surface. Whenever the temperature approaches freezing, the controller energizes the heating elements and, after sufficient rise in pavement temperature, de-energizes them. Present settings are 36 F "on" and 38 F "off". These settings allow for the temperature gradient which exists between pavement surface and the point at which the detector is embedded.

At the present time, the master control switch is thrown, by hand, about an hour before snow or ice conditions are predicted by the Weather Bureau. The switch is pulled open, by hand, after all possibilities of driving hazards have passed.

Tests to date indicate the technique to be effective and economical. A 4-in. snow fall was easily and satisfactorily disposed of. At that time the heating elements consumed about 40 kwhr per hour per 500 ft of section. At a rate of 2.5¢ per kwhr, this costs $1.00 per hour. Tests will continue. It is hoped that a device to predict snow and icing conditions can be developed so that the installation can be made automatic.



THREE 50 KVA transformers are utilized in energizing each 98 ft. of embedded heating element so that each side of the roadway is at the same potential

Motor Size Confusion Hinders Farm Service Development

Lack of uniformity in utility service rules and practices . . . Farmers and makers of farm equipment frequently over-estimate power requirements of drives

C. P. WAGNER
Rural Sales Manager
Northern States Power Co
Minneapolis, Minn.

SELECTION of proper motor size and type for farm operations is essential to economy for the farmer. Likewise, it is essential for economy in energy supply to the farmer. Unfortunately, much confusion exists in this respect. Equipment manufacturers, electricity suppliers, and farmers often are at variance in their ideas as to the power requirements of a given operation.

Some of the reasons for this confusion resides in the diversity of utility rules and practices in farm service. It was found in a survey of representative utilities that nearly all companies will "take on" motors up to 5 hp on the base rate; others place the ceiling at 7½ hp; a few limit the size to 3 hp. See Table I. Also, it is common knowledge that some companies are lax in inforcing service rules—they, in effect, look the other way when "over-rule-size" motors are installed. Also, rumors have been heard that some farm service advisers once in a while change motor name plates and that others remove or paint them out. Such practices stem from lack of close association between farm service men and distribution engineers who are charged with the duty of maintaining service quality. Plenty of hot discussions as to the farmer's needs and the ability of the system to meet them may punctuate the association of the engineer and the farm man, but both will profit and better service to customers will result.

Many Operations Under 10 hp.

Most common farm operations can be performed by motors under 10 hp. It is the exceptional case which would require a 10-hp or larger rating. Also, many distribution engineers are not too concerned about the starting currents of motors 10-hp and under. The first problem then, is to determine the maximum size which can be served, draft the rules accordingly and then inform farm equipment suppliers of that action. They then are in better position to cooperate with the utility and its farm customers in removing confusion and bringing power to the farm user at the lowest over-all cost.

Lowest cost of farm electric service will be attained in most areas if motors are limited to single phase types. This statement is made in consideration of the farmer's requirements and best interests—agricultural engineering, farm economics, and farm equipment operation—and of the utilities problems in distribution. Good agricultural engineering and farm economics indicate that it is undesirable to have the electric motor compete with gas engines or tractor engines already available on the farm unless the operation is designed to be automatic rather than to require associated labor. It is hard to see how motors larger than 10 hp can be needed for automatic operations.

It may be said that agricultural engineering research has proven that motors of 10 hp and less will perform the work required on almost all farms in non-irrigated areas. It is obvious that there are farms and farm operations which may require larger motors. It is to the advantage of both farmer and utility that a smaller motor for a particular application be carefully considered and that decision to use a larger one is not just snap judgment. We are convinced that an upper limit of 10 hp is ample for all but most exceptional cases.

The 10-hp limit is a natural one because most manufacturers produce single-phase motors up to this size. Larger single-phase motors are available but for the most part they are limited in application to specific locations where high voltage service is available. Such motors cannot be considered for use on rural lines of 7,200 v or less. But on most lower voltage lines, farmers can use motors up to 10-hp without causing distribution difficulties.

Most farm machines now available can be selected to operate at less than 10 hp. Some machines should be redesigned, some can be easily revised at location, to do their work within the limits of 10 hp. One of the best examples of this is in the field of hay elevating. Power requirement is materially reduced as the diameter of the blower is increased. Many of the present machines are designed for blowers having rotors of small diameters.

Representative Practices

Table I shows the maximum motors allowed under rates or extension rules by a number of companies. These rules are to the best interest of the farmer since the rates of these companies are very low. These regulations indicate that the largest market is for equipment that can be operated with 5 hp. It would appear, therefore, that in all research work and machine design the manufacturer should approach the problem with the basic thought of using a motor or motors of not more than 5 hp. He should not recommend a larger motor unless he

is perfectly certain that 5-hp will not be adequate.

Motors larger than 5-hp and up to and including 10 hp will, in some cases, require the application of other than the residential rates frequently available for farm service. In areas of lower customer density the general service "farm rate" will usually permit use of such motors. It must be remembered, however, that connection of them may depend upon "ability to serve" and the power company should be consulted.

Service rules and regulations are based on the premise of protection for both customer and company against conditions that would result in poor service to any customer and his neighbors. They do not allow the connection of certain loads which would entail excessive expenditures for maintenance of high quality service. They also prevent discrimination.

These regulations, also, provide for possible requirement of reduced voltage line starters on larger single-phase motors in order to minimize voltage dips. These are often required in critical service areas. However, most companies do not specify them for farm service motors located in areas where only one or two customers are served from one transformer. It may be, however, that the customer will find that the load starts too fast for the machine to stand if the motor is thrown across the line. In these instances he will find it to his own best interest to install a reduced voltage starter.

TABLE I—Representative Practices in Regard to Farm Motors and Rates Applicable to Them

Replies	Are farm customers served on a residential or on a distinctive farm rate?	What is the largest motor allowed on this rate?	What is the largest single-phase motor allowed on rural lines?	Is another rate applied for motors larger than those allowed on the usual rate?	Is distribution department concerned about farm motor starting currents?
1	Res	7½	10	over 7½	no
2	Farm	10	10	.....	no
3	Res	10	10	.....	no
4	Farm	7½–10	10	.....	?
5	Res	7½	7½	.....	?
6	Res	7½	10	.....	yes
7	Farm	10	10	.....	yes
8	Farm	5	7½	yes	no
9	Res	7½	7½	yes	no
10	Farm	5	7½–10	no	no
11	Res	7½	7½	yes	no
12	Res	7½	7½	.....	no
13	Farm	3 to 5	7½	yes	no
14	Res	.....	5	.....	.....

Unfortunately, the farm motor problem has become larger because of the trend towards doing more chores with electricity and fewer with the tractor. There is a considerable misunderstanding about the horsepower output of the usual tractor on the farm. The average tractor output on belted machines is something of the order of 27 to 33 hp. Farmers sometimes ask for as large as 50-hp electric motors to replace these tractor drives. In fact, some machine manufacturers recommend this. This is unfortunate and unjustifiable because of the notoriously low load factor of farm power equipment.

Important in this connection are the comparative capacities of an electric motor and a gasoline engine. In respect to constant loads, no more power is required from one than from the other. However, when such constant loads are encountered on the farm, the rate of work performance can often be adjusted to any power capacity. One of the constant power load jobs is small grain grinding. In this case, the rate of feed can be adjusted so uniformly that with a flow of 2,000 or 3,000 lb per hr, the variation need be no more than two or three pounds per hour. Obviously, then, small grains can be ground with motors of any capacity from 1 hp up. Actually, our most efficient feed grinders are in the range of 1 hp and the only reason for motors as large as this is that the throat feeding mechanism of smaller feed mills is not large enough to permit a uniform flow of most uncleaned grains. The smaller the grinder the easier it is to adjust to automatic operation.

Many farmers think extremely large motors are necessary for grinding ear corn. Ear corn crushers have been provided to operate with motors as small as 1 hp. A 3-hp motor can operate a crusher at the rate of five tons per hour. The crushed ear corn can then be ground through automatically with a reasonable sized hammermill. Where this is not practical a 3 or 5-hp motor connected to a plate mill will grind ear corn at high capacity at low cost. Such a mill is inexpensive and can supplement the regular feed mill.

Acutally, as farm equipment is checked, it is found that variable loads may range as high as 250% of the motor rating and still not average the full load rating of the motor. In other words, the motor does not overheat. Also, if the momentary overloads do not exceed 250%, the motor does not reach pull-out torque; it does not go off the line and stop.

As larger motors are applied to fluctuating loads the energy required

Uses Requiring No Larger Than 3-10 hp Motors

Mow hay finishing	Feed mixing
Grain drying	Corn husking
Corn drying	Barn cleaning
Seed corn drying	Water pumping
Silo filling	Irrigation—small
Elevating field cut crops	Grass silage cutting
Feed grinding	Hay chopping
Roughage chopping	Crop refrigeration
Ear corn crushing	Bone grinding

Energy Cost Gasoline Versus Electricity

From studies reported by Dr. E. G. McKibben while he was at the Iowa State College a summary of the cost of gasoline for tractor power is as follows:

The cost of gasoline per lb at 25¢ per gal equals 25¢ divided by 6.12 or slightly more than 4¢ per lb. (6.12 lb of gasoline equals 1 gal of gasoline.)

1. Tractors at full load consume about 0.6 lb of gasoline per hp-hr output.
2. Tractors operating at one-half load consume about 0.8 lb of gasoline per hp-hr.
3. Tractors operating at one-fourth load consume about 1.0 lb of gasoline per hp-hr.

At these indicated rates of gas consumption with gasoline at 25¢ per gal the cost of operating tractors per hphr at full load, half load and one-quarter load would be 2.4, 3.2 and 4.0¢. In terms of kwhr, these figures become 3.2, 4.3 and 5.3¢, and are directly comparable to the cost of electricity used by a motor to do the same work.

The cost per kwhr at other prices for gasoline can be easily determined from these data.

for work performed increases rapidly. If the motor size, for instance, is doubled the kwhr used will much more than double. An excellent example of the increased kwhr and lowered power efficiency is furnished by the ensilage cutter. The 7½-hp motor seems to be optimum. A machine at correct speed for elevating may take approximately 2½ hp at no load leaving 5 hp effective for work to full load and some 10 to 12 hp for momentary overloads.* Ensilage can be placed in the silo with a consumption as low as ⅔ kwhr per ton.

When the motor size is increased, it is necessary to increase the speed of the cutter. No-load requirement of energy increases materially; the kwhr per ton may be doubled or tripled. Using a 20 or 30-hp motor, a consumption of 2½ or 3 kwhr per ton can be expected.

Threshing Machine

The threshing machine is another example of the advantage of small motors. One motor on the cylinder, a motor on the stacker fan, and a motor on the shaker, probably a 10, a 3 and a 1½ hp respectively, will do the work nicely.

In one case a 23-in. cylinder machine is being operated with a 25-hp motor. The farmer feels that this is not excessive. However, a check of the load indicated that a 15-hp motor would have been ample. The one point to remember is that on variable loads, the electric motor can jump instantly up to 250% load with little change in speed. This is not true of tractor operation.

One of our customers was operating a 10-hp, single-phase motor on a blower at 1½-in. static pressure for seed corn drying. The blower in use supplied 20,000 cfm of air. The customer wanted to increase the air output and he wrote to the manufacturer for advice. The manufacturer replied that a 20-hp motor on the same blower would deliver 26,000 cfm at the same pressure. Immediately the customer asked us to supply service for a 20-hp motor.

When engineers checked the cost of this they found it to be $3,500. The district representative immediately referred the job to the general office agricultural engineer. The local market was checked and a fan which would deliver 28,420 cubic feet per minute at the same static pressure for 9.59-hp was found. The customer bought this fan for $270.00. He was happy and so were we.

The results in this case were savings to the power company of $3,500, and to the farmer of the cost of a complete rewiring job. Also the farmer saved because he got the required amount of air for one-half the kwhr he would have used with the 20-hp motor. This particular job shows the value of good use of engineering knowledge on the part of the farm service advisor. The values accrue to the power company and to the customer in first cost and will continue to accrue to the customer to the extent of nearly one-half his annual use of electricity. Incidentally, from the power company's viewpoint, this motor operates only about five weeks per year.

There is a known good engineering practice which will allow motors of 3 to 10 hp to be applied to each of the many motor uses in an accompanying list. Power company farm service advisors are familiar with these practices. Mow hay finishing seems to be the application most often in dispute and is discussed here to illuminate the argument for the small motor.

The problem in mow hay finishing is adequate air flow, employing motors within the capacity of the line and at the lowest possible cost for power. These conditions can be met with motors of 3 to 5 hp for any power company line capacity or rate now found.

Air flow needed is at least 15 cfm per sq ft of mow floor area, at ¾ in. static pressure and without falling off very much at 1 in. static pressure. The 5-hp motor will serve from 1,200 to 1,700 sq ft of mow floor area. The difference between these figures is determined by the diameter of the fan in use. The larger the fan the more air is delivered per hp. Two 5-hp motors operating 42-in. propeller fans will serve two areas each 36 x 40 ft. This is equal to the floor area of the mow in a barn 36 ft wide and 80 ft long. If the fan is of correct design, the mow may be filled with chopped hay to an 18-ft depth, particularly if the air ducts are designed along the

TABLE II—Mow Hay Finishing

Fan diameters and motor sizes to supply 15 cfm of a per sq ft of area at ¾ in. static pressure to various size of mows

Fan Dia. inches	Motor, hp	Capacity, cfm	Area, sq ft	36-ft Barn, length
		Propeller Fan		
36	5	19,000	1,260	35
42	5	21,500	1,440	40
42	7½	26,600	1,730	48
48	5	24,000	1,590	44
48	7½	29,600	1,980	55
48	10	33,000	2,200	61
60	10	44,750	3,000	83
		Twin-unit forward-curved multiple-blade centrifugal fan		
21	3	12,000	800	22
21	5	16,500	1,100	30
21	7½	21,500	1,430	40
25	3	13,500	900	25
25	5	19,000	1,260	35
25	7½	24,500	1,630	45
30	5	23,000	1,530	42
30	7½	28,500	1,900	53

* See "Urges Smaller Motors for Farm Machinery" by C. P. Wagner; Electrical World, Vol. 121, April 1, 1944, p. 104.

lines of the Wisconsin System. In other systems the depth may be less. For a single system and for larger size motors, see Table II. For 7½-hp motors, very often more than one motor may be recommended. Same recommendations hold true for a 10-hp size but these would be less often.

One important feature of mow hay finishing is that the motor load is constant. The power company will not be troubled with voltage drop from starting current. They may, therefore, allow larger motors for this operation than for other farm applications.

Some designers state that larger capacity than that available from electric motors is desired. They, therefore, use gas engines with the propeller fan on the engine shaft. They also get heat from the engine radiator to assist in drying. These engines may be a good investment in some areas where motor size is very restricted. However, for our area we find that 10-hp motors which are allowed occasionally, can be connected to a fan large enough to deliver more air flow than is available from 20 to 25-hp gas engines and usual fan. With the present cost of gasoline and electricity, there is no longer any idea that the gas engine is the cheapest to drive. The accompanying comparison of gasoline and electric energy costs dispels that idea.

From this brief discussion it is apparent that the three parties in interest, farmers, makers of farm equipment and power suppliers, should come to agreement on motor size requirements. It is also apparent that the weight of evidence is towards single-phase motors no larger than 10-hp as adequate for most farm tasks. Until such agreement is reached farm electrification will not progress as it should and can. This will require an educational job devolving squarely on the power suppliers. But first they must put their own house in order in respect to farm service rules and practices.

Visual Flashover Indicator

H. L. RORDEN
Bonneville Power Administration
Portland, Ore.

INSULATOR FLASHOVERS on transmission towers are quickly located by a visual indicator developed by engineers of the Bonneville Power Administration. Results of three years' experience on over 300 miles of 230-kv line have been very satisfactory.

Flashovers usually mark only the upper surface of insulators, and most commonly the top or ground end insulator is crazed from power burns on the upper surface if arcing horns are not provided. Patrolmen have difficulty in locating such flashovers from the ground and even sometimes from helicopter patrol, if the marking is not very prominent.

Visible Target

The indicator consists of a target normally held within its housing by a small capsule containing black powder. It is located on the lowest convenient horizontal steel member of the tower, so that the target is visible from the patrol road as well as from an approaching helicopter. Target faces are provided with glass beads so that they are visible at night by shining a flashlight on them from a patrol car. Since they are mounted near the ground, it is possible to inspect and replace cartridges without climbing the tower. The capsule consists of a small glass tube about

POWDER CAPSULE, exploded by current shunted from tower member through it to separate ground, drops target as visual signal that a flashover has occurred

¾ in. long with an inside diameter of about $\frac{1}{16}$ in. Brass wire electrodes are cemented into each end leaving a separation of about $\frac{1}{16}$ in. within the tube which is filled with powder. The target is hinged so that in the normal closed position the free end of the cartridge rests on a spring clip thereby holding the target in the closed position. When so mounted, one electrode of the cartridge is connected to the tower member, the other to an insulated wire running to a separate driven ground rod a foot or more away from the tower leg.

The ground rod is about two feet long, and is usually driven within the backfill either within or outside the tower configuration. Use of a separate ground rod provides more than enough potential so that flashover of any kind, either lightning or power, produces enough voltage across the powder capsule to flashover, exploding the capsule, and dropping the target. If the ground rod is driven more than a few feet away, there is usually too much potential and too much current so that the contacts supporting the capsule may be damaged. It is desirable to explode the capsule with as little current as possible to avoid unnecessary damage.

Separate Ground

The method of using the separate ground is positive in supplying sufficient potential, whereas spanning a section of the steel tower does not provide sufficient potential drop to assure enough voltage to explode the cartridge. Use of black powder is preferable because of its lower ignition point than smokeless powder or other varieties. The electrodes are sealed in the cartridge by shellac which provides an easy method of assembly as well as a sealed joint impervious to moisture and other weather conditions.

This simple and inexpensive device is providing valuable information in lightning protection studies as well as effecting a considerable saving in patrol costs.

Buying Habits of Distribution Transformers With Respect to Voltage

Analysis of one manufacturer's sales records indicates that by using 2,400 and 7,200-v distribution transformers, utilities gain (1) maximum interchangeability, (2) maximum availability from stock and (3) minimum unit cost

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Transformer and Allied Products Division
General Electric Co
Pittsfield, Mass.

NUMEROUS REQUESTS have been made for data indicating the relative usage of distribution transformers for different standard primary voltage ratings. Such data would help solve some of the problems revealed by wartime operation and during the period of scarcity immediately after the war. Among these problems, are:

1. The difficulty of easily interchanging equipment among users in times of crisis, because of the wide diversity of ratings and requirements.

2. The difficulty of procuring several sources of supply during times of scarcity, because of the limited demand for certain specific ratings.

3. The more rapidly rising cost of low usage ratings during periods of great national expansion, because of the depressing effect of great variety on the output from a given size of manufacturing plant.

That these and similar problems should arise is not unusual. Despite the excellent work of the EEI-NEMA Joint Committee on Distribution Transformer Standards and the wholehearted acceptance of these standards, approximately 500 single-phase, oil-filled distribution transformer ratings with primaries of 15,000 v or less are specified by the industry. The demand for most of these ratings is relatively small. Many are used by only a few purchasers, while a few ratings are used by many purchasers all over the country.

Recognizing this fact, an alert user naturally would prefer, if possible, to build the expanded portion of his system around the more popular of these ratings. Thus he would assure himself of the maximum degree of interchangeable equipment, multiple sources of supply, minimum purchase price and maximum availability of manufacturers' stocks. By adding his purchases to already popular ratings, he further protects the continued popularity of his selection for the future. These decisions cannot be made on information in the standards, which give equal weight to all ratings included. This information comes from asking specific questions with respect to the transformers standards.

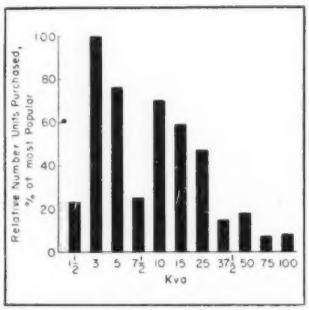

Fig 1—RELATIVE NUMBER of sizes of distribution transformers purchased, regardless of voltage

One basic question is the relative popularity of different primary voltages for distribution transformers. The selection of a voltage commits the system to a fairly inflexible long term program. In times of trouble, kva sizes can be used other than those considered ideal. If circumstances require, conventional or completely self-protected transformers can be used, despite preference for one or the other. But with respect to voltage, there is little freedom of action once the nominal voltage is selected.

To the manufacturer, voltages are equally important. The variety of voltages selected nationally is an important factor in determining the variety of such components as cores, wire, and tanks that the manufacturer must be prepared to make and the amount of planned plant diversity. This diversity is in the form of extra or more versatile machines and extra or more highly skilled labor. Also it determines the service that can be offered customers with a given volume of finished stock and the turnover or cost of carrying that stock.

There is then an opportunity during periods of expansion to inadvertently increase, either temporarily or indefinitely, the already great diversity of industry requirements. On the other hand, knowing national buying habits, it is possible in such times to take steps to narrow or consolidate the field with obvious benefits in better service, greater flexibility, and reduced cost. Undoubtedly, such considerations have motivated the present interest regarding the popularity of the various standard voltages.

To give an answer to such a broad question is not easy. One possible approach is an analysis of manufacturers' sales records. Such a record may give a reasonably accurate picture if:

1. The manufacturer has a sufficiently broad national sales coverage so that the results are not affected by the weight of sales to only a few large purchasers.

2. The sales period analyzed is

long enough to minimize the weight of the individual customer's purchasing habits.

3. The volume of sales analyzed is sufficiently large to give assurance that the two factors mentioned above have been effectively averaged out.

4. The period analyzed is one of broad national expansion so that all areas of the country are well represented.

It is felt that a sampling of orders from a large company, such as the General Electric Co. taken during the year 1947 gives a reasonably representative picture of the buying habits of distribution transformer purchasers with respect to voltage. The results of this analysis are shown in Fig 1 and 2. These charts analyze a sampling of more than 150,000 distribution transformers ordered in 1947. They include only transformers purchased by the privately owned utilities. The types of transformers purchased by the Rural Electric Cooperatives have been purposely omitted because of the added weight they would give to the higher voltage classes, particularly the 7,200-v class.

Popular Sizes

The proportion of the total sample ordered in each kva size, is shown in Fig 1, and the distribution of the sample by kva is irrespective of voltage. Also, this chart provides an interesting verification for the elimination of the 1½ and 7½ kva sizes in the EEI-NEMA Fourth Report.

The popularity of various voltages is related to the kva size. For example, smaller transformers are likely to be used more frequently on rural lines than on urban systems. Usually, these transformers are in the higher voltage classes. It is also likely that more of the smaller units would be purchased than of the larger sizes. This is particularly true of the last few years. If all sizes were lumped together, it is quite likely that too great an emphasis might again be given the higher voltage classes. For this reason, the analysis of the sampling has been separated to show the relationships for 1½ through 5 kva, 7½ through 15 kva, 25 through 50 kva and 75 through 100 kva, respectively in Fig 2.

To establish a bench mark from which to obtain some indication of the trend of purchases, a sampling of more than 100,000 units purchased in 1941 is shown in the bar-diagram Fig 3.

The facts are evident from the charts, within the limitations of the data from which they were obtained. Although elaborate conclusions are not possible, some findings can be

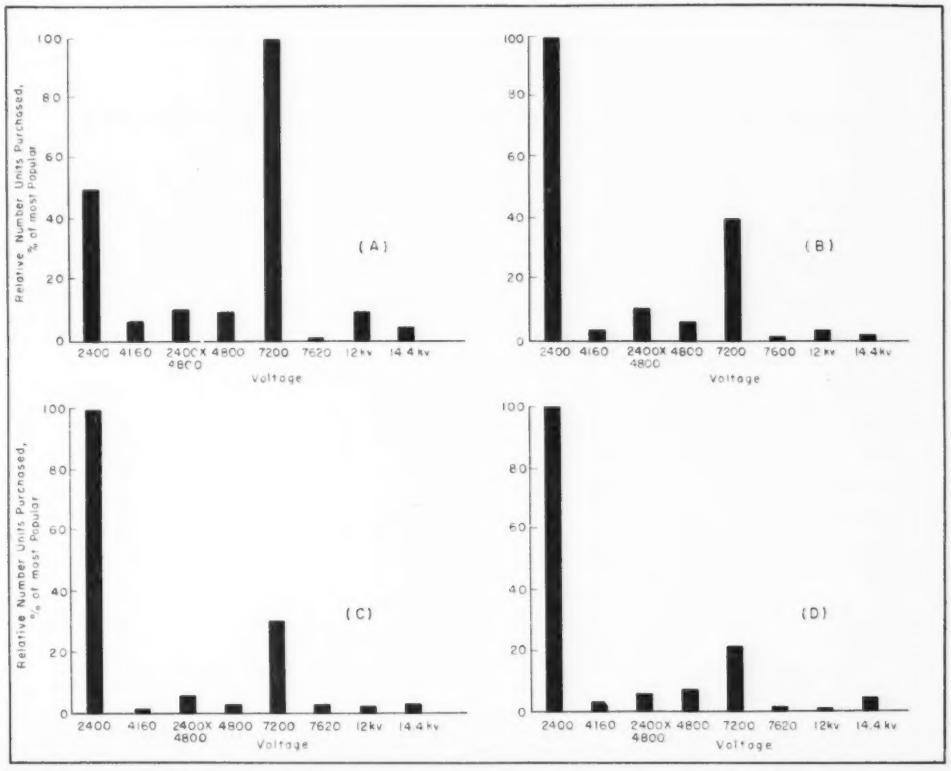

Fig 2—1947 COMPARISON of purchases for different sizes of distribution transformers in terms of primary voltage: (A) 1½-5 kva; (B) 7½-15 kva; (C) 25-50 kva; and (D) 75-100 kva. Ratings are inclusive.

stated with reasonable assurance. These are:

1. The predominant voltage classes in 1947 and also in 1941 were 2,400 and 7,200. For 1941 the 6,900 and 7,200-v ratings are considered as one class.

2. The 2,400 and 7,200-v classes have continued in favor over the six year period.

3. There has been some increased use of the 7,200-v class in 1947 as compared with 1941, particularly in sizes 7½ through 50 kva.

4. There has been some relative decrease in the use of the voltages between 2,400 and 7,200 v.

Based on these conclusions, utilities should give serious consideration to the 2,400 and 7,200-v distribution transformers if they are seeking easy interchange of equipment in times of crisis, maximum service from manufacturers' stock and equipment most likely to have the minimum price over the years because of volume production.

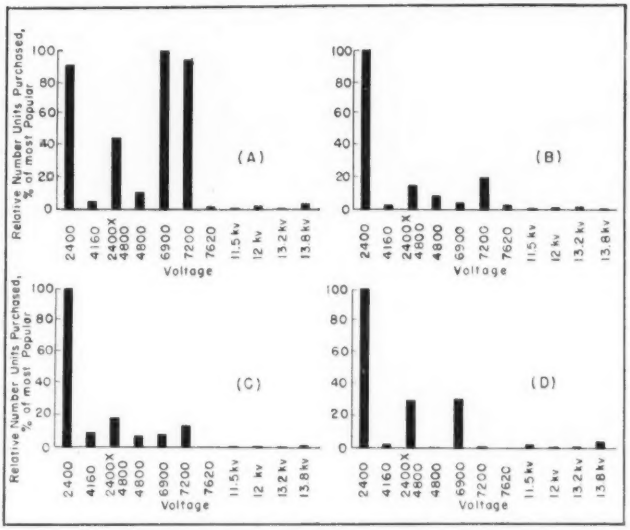

Fig 3—1941 COMPARISON of purchases for different sizes of distribution transformers in terms of primary voltage: (A) 1½-5 kva; (B) 7½-15 kva; (C) 25-50 kva; and (D) 75-100 kva. Ratings are inclusive.

Inspecting Transfer Equipment in Duplicate Service

IMPORTANT CUSTOMERS having duplicate service from an eastern utility are often provided with automatic transfer equipment. So vital is service continuity in such cases that special care has been taken to insure regular and thorough joint inspection by the utility meter and construction departments. The meter department is responsible for the testing and setting of all relays in connection with these installations. This includes stocking all required spare parts.

Routine Inspections

Inspections of routine type are scheduled monthly. These involve testing both normal and emergency 2.3-kv services with a neon tube and checking as to whether all control circuits are alive. The circuit breaker is not operated, but the time to transfer is measured by having the construction man hold the oil breaker closed, while the meter department man opens the control switch which de-energizes the relay, and by using a stop-watch obtains the time in seconds for the trip coil to operate.

Unless conditions are urgent, cleaning and lubricating the relay and circuit breaker mechanism are postponed to a semi-annual inspection set for February and August. Control switches are always required to be opened before cleaning and lubrication work is started. Care is taken to open the control switch to the trip coil first. On routine inspections all positions of relays, targets, etc, are reported "as found", unless otherwise called for. It is assumed that all such equipment will be left in normal position; but if this cannot be done the fact is noted by the inspectors. By this procedure no interruption of the customer's service occurs.

Throw-over Inspections

In these semi-annual check-ups the breaker is tested in actual operation. All relays and mechanisms are cleaned and lubricated. Bearings of mechanical linkages involved in breaker operation are cleaned, both inside and outside, and also lubricated before the breaker is operated. This gives the light bearing oil used an opportunity to work in. The breaker is then operated by opening the holding coil circuit in the relay and measuring the time from this instant until the switch transfers the load to the emergency supply. The time is measured by stop-watch and on this system is scheduled between six and eight seconds. If it becomes necessary to have several operations to adjust the timing, the load is purposely left on the emergency feeder and the timing checked by the operation of the trip coil only. After the work is done, it is required that the load be restored to the regular feeder. With this method there will be but two interruptions to the customer's service.

Every two years, at the time of the regular periodic throw-over inspection the tank on the oil circuit breaker is required to be lowered, and the oil tested. Before any test is started the utility's maintenance supervisor makes arrangements with the customer for the necessary momentary interruptions of service involved in throw-over tests.

Loading for Meter Tests Controlled Automatically

Differential scheme acts through rotating contacts to relay the correction for discrepancy between fluctuating and desired wattsecond rate

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FACTORY TESTING of thermal demand meters requires the accurate holding of loads for extended periods of time. Manual load holding, originally employed for all Lincoln demand meter testing, has now been superseded by automatic load control for most watt demand meter testing.

The circuits employed in automatic load control are shown schematically in Fig 2. These circuit elements are the same as are employed in manual load control* except that the indicating wattmeter is replaced as the secondary standard by a watthour meter element whose rate of rotation is compared to that of a synchronous motor.

Deviation of the watthour meter speed from that of the synchronous motor, due to too high or too low load in the circuit, operates through contacts to lower or raise the load to correct for the deviation.

Load Control Element

A schematic representation of the load holding element is given in Fig 3. A small 120-v, 60-cycle synchronous motor, operating at a speed of 240 rpm, is geared down to rotate a contact-carrying disk at a speed of 1 rpm.

A 120-v, 1½-amp meter, with constant of 540 watt-sec per disk revolution, is geared down 200/3 to rotate a contact arm concentrically with and in the same direction as the contact-carrying disk. At 600 w, or 400% load, on the watthour meter its speed would be 600 w 540 watt-sec per revolution or 10/9 rev/sec; at this load, then, the contact arm would also rotate 1 rpm and there would be no relative motion between the contact arm and the contacts driven by the synchronous motor.

Four contacts are carried by the motor-driven disk. The two contacts which directly lead and lag the meter-driven contact arm serve, respectively, to lower or raise the load. The other two contacts, which close only if normal operation fails to correct the load, are limiting or protective in action and the closure of either one acts to open the load circuit. As these two last contacts are tied together, only three slip rings are required to collect the circuits from the contact disk. The meter-driven contact arm is grounded to the train through its bearings. Since the meter element operates only at 400% load, the conventional upper and lower bearings are replaced by conical pivots running in ball bearings.

Sequence of Operations

In order to operate with the control circuits grounded at the contact arm, an isolated 120-v supply is provided by a small 240/120-v transformer excited from the 240-v line. Two small pilot relays, electrically interlocked to prevent simultaneous operation, are energized by this circuit through the contacts of the load holding element to repeat the position of these contacts. These pilot relays, in turn, energize two larger relays which repeat, at a power level, the position of the pilot relays and the load-holder contacts.

Thus, if the load at the watthour meter element is greater than 600 w, the central contact arm advances, relative to the contact disk, until it makes contact with the leading contact. This completes a circuit through the normally closed contacts of the "raise load" pilot relay and energizes the coil of the "lower load" pilot relay. The operation of the "lower load" pilot relay, in turn, completes a circuit through its normally open contact to energize the "lower load" power relay. When the "lower load" relay operates, it immediately reduces the load by 10% and simultaneously starts a motor which drives the load control variac in the direction to reduce load.

When the load to the watthour meter element is reduced sufficiently, the load holder contact opens, deenergizing the pilot and power relays, restoring the increment of load which was dropped while the "lower load" power relay was energized; but leaving the load control variac at a somewhat lower setting than before. Conversely, if the load on the watthour meter element is less than 600 w, causing the trailing contact to close, the "raise load" pilot and power relays operate to add a 10% load increment and to rotate the load control variac in the direction to increase load.

Load Circuits

The addition or subtraction of a 10% load increment is accomplished by means of an auxiliary loading transformer whose primary is excited in parallel with that of the main loading transformer and whose secondary is connected in series with that of the main loading transformer. When the "lower load" relay is energized, this series connection is subtractive; when the "raise load" relay is energized, it is additive to the output of the main loading transformer; and

* See "Thermal Demand Meters Gang-Tested and Checked," Electrical World, April 23, p 79.

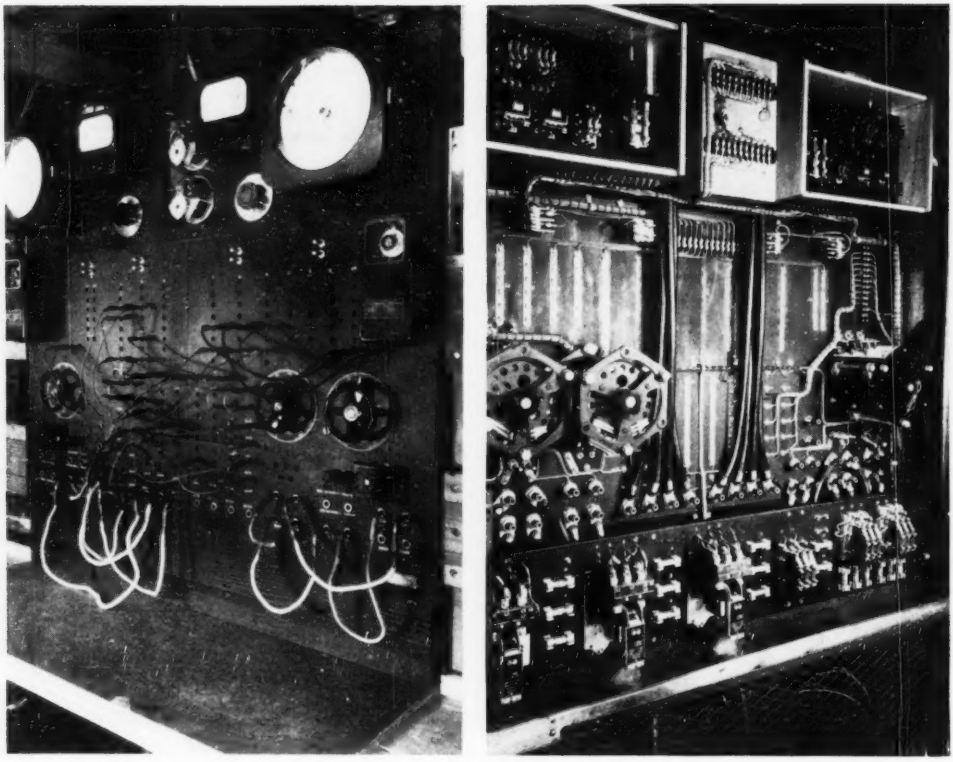

FIG 1—METER-TEST loading controlled automatically between racks of thermal demand meters: front (left), rear (right)

when neither relay is energized, the primary of the auxiliary transformer is shorted by the relays to make it of negligible series impedance to the loading circuit. The two power relays are mechanically interlocked to prevent the short circuit which would occur if, through some relay or circuit fault, both relays were closed simultaneously. A resistance-capacitance shunt across the primary of the auxiliary loading transformer is employed to suppress sparking of the relay contacts.

A third set of contacts on each power relay operates a reversible single-phase motor which drives the load control variac through a large gear reduction. A friction clutch, interposed in this drive, permits manual adjustment of this variac.

Starting Load Holder

In starting the automatic load holding equipment, the 240-v circuit is closed by momentary closure of the push button, (Fig 2), energizing the cut-out relay which locks in mechanically. The phase and magnitude of the load is then adjusted so that 600 w will be applied to the watthour meter element of the load holder. Potential is not applied to the load-holding element, however, until after this load is set. The potential switch is then closed, energizing the potential circuit relay from the isolated 120-v circuit, which in turn applies 120 v from the line to the watthour meter and synchronous motor of the load holder and 120 v from the isolating transformer to the pilot and power relay circuits. This relay supply is held open until the load holder potential circuit is energized, since the load holder might be left from a previous operation with one contact closed, in which event the motor drive of the load control variac would tend to upset the load as fast as it was established manually. As soon as this sequence of operations is complete, the load holder takes over control of the load.

Protective Features

If the load has not been properly set to within approximately 10%, plus or minus, of the 600 w required by the load holder, the 10% change of load which occurs when one or the other of the load holder contacts is closed will not be sufficient to stop further relative motion between the contact arm and the contact disk of the load holder. Unless the load control variac drive can operate quickly enough to correct this condition, this relative motion of the load holder contacts will continue until one of the outside, or limit, contacts of the disk is grounded. When this occurs, the release coil of the cut-out relay is energized, opening the 240-v load circuit. A similar protective action occurs if, during a test, due either to abnormal line voltage variation or a short or open circuit, the

load holder is called upon to correct a load variation in excess of its corrective capacity.

This cut-out feature is necessary not only to protect the meters under test but, especially, to prevent damage which would result to the contacts of the load holder if it attempted to drive past the limit contacts. A similar consideration explains why the isolating transformer is excited from the load side of the cut-out relay. If potential only were applied to the load holder, the synchronous motor would continue to drive the contact disk with the contact arm stationary, which would result in damage to the contacts; but since the relay through which potential is supplied to the load holder is energized from the isolating transformer, opening of the 240-v line also removes the 120-v line from the load holder.

Since the load held by the load holder is set by the constant of the watthour meter, the supply frequency of the synchronous motor, and the ratios of the gearing by which the two motions are compared, the load which will be held, at the load holder, can be changed only by changing one of these factors. Practically, none of these can be changed readily and recourse is taken to varying the relation between the actual load and the corresponding load at the watthour meter element. Thus, using the load holder in conjunction with the 25/5, 50/5, and 100/5 current transformer would provide operating points of 5, 10, and 20 times the basic load of the load holder; i.e., in addition to 600 w, obtainable without the current transformer, loads of 3 kw, 6 kw, and 12 kw at 120 v, and corresponding loads at other voltages, can be automatically controlled. As this range of loads includes both half-scale and full-scale for 15 and 50-amp Lincoln watt demand meters, it provides for a large percentage of meters tested and the original installation was made, and justified, with this relatively inflexible schedule of loads.

Subsequently, however, an auxiliary multi-range current transformer was provided to supply additional load control ranges. This transformer, built as an autotransformer, carries as its secondary burden only the load holder and the graphic demand meter associated with it. Its primary connections are selected by a 12-position switch, giving 12 different load values which can be held, ranging from 187.5 w to 1,500 w, when it is connected directly in the line. When this auxiliary current transformer is excited from the secondary of the 3-range current transformer, these values may be multiplied by 5, 10, or 20, giving in all, after eliminating duplications and loads outside the capacity of the main current transformer, some 36 load values, at 120 v, ranging from 187.5 w to 12 kw. This vastly increases the flexibility of the system

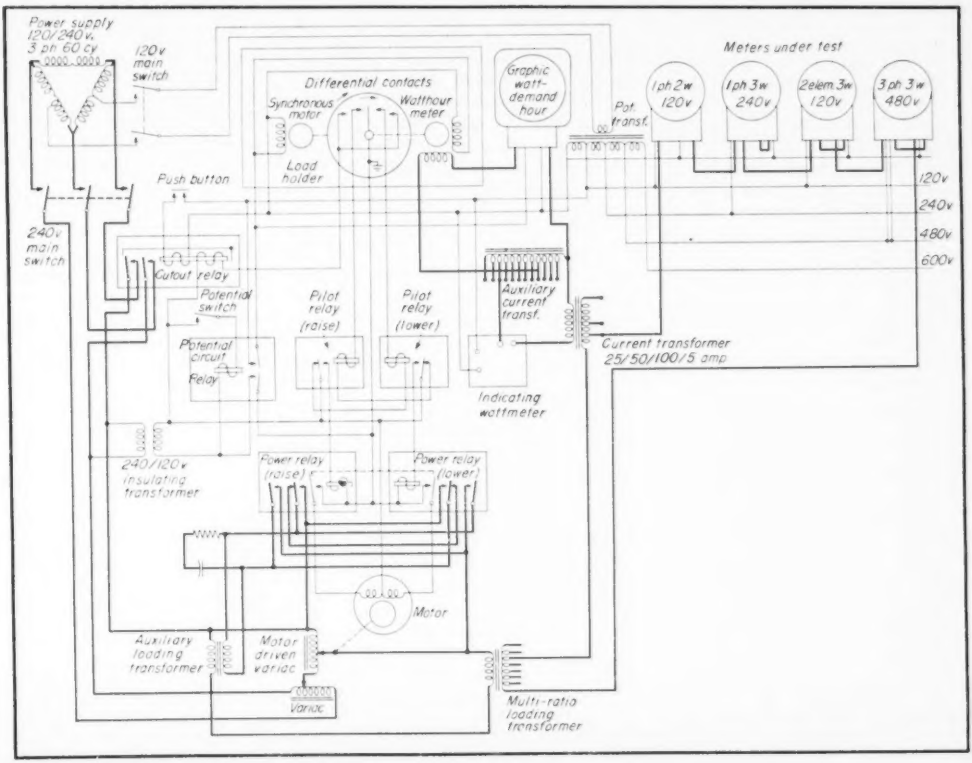

FIG 2—AUTOMATIC load holding circuits are shown schematically

and permits the automatic control of almost any load the testing equipment is called upon to supply.

Accuracy Considerations

The average load held depends upon the accuracy of the watthour meter element calibration, upon the frequency supplying the synchronous motor, and, of course, upon the accuracy of any instrument transformers between the load and the watthour meter element. The accuracy of the watthour meter is, for practical purposes, the accuracy with which it can be calibrated at the operating point, since the mechanical load of the contacts is negligible and the normal variations of power factor, voltage, and temperature are slight. Supply frequency to the synchronous motor is, in general, accurate to 0.15%; but under abnormal frequency conditions correction of meter calibration may be made on the basis of observed frequency drifts. At worst, instrument transformers may introduce a small constant error for which correction can readily be made.

Effect of Load Averaging

While the instantaneous load may vary by approximately 10%, the load holder tends to hold the average load constant. The integrated error necessary to produce corrective action is represented by the distance the contact arm must rotate from its mean position to make contact with either of the motor-driven disk contacts. The design of this equipment, based upon a compromise between frequency of contact operation and accuracy, is such that contact is made and corrective action taken when the integrated error of the load is approximately 500 wattseconds.

The effect of a maximum integrated error of 500 wattseconds in the average load, in terms of its effect upon the watt demand meters under test, may be evaluated by considering how rapidly a thermal demand meter can follow a changing load. A 15-minute meter changes its indication at a maximum rate of approximately $\frac{1}{4}$% per second of the difference between actual and indicated load. If, then, the load deviates from 600 w until an integrated error of 500 watt-sec exists, the maximum change in meter indication will be $\frac{1}{4}$% per second of 500 watt-sec which is $1\frac{1}{4}$ w or 0.2% of 600 w. Thus, under the most unfavorable conditions, an accumulated error of 500 wattseconds in the average load cannot affect a 15 minute meter by more than 0.2%; nor a 30-minute meter by more than 0.1%. In actual operation the graphic watt demand meters associated with each equipment show no appreciable fluctuation in the record while the load is being held automatically.

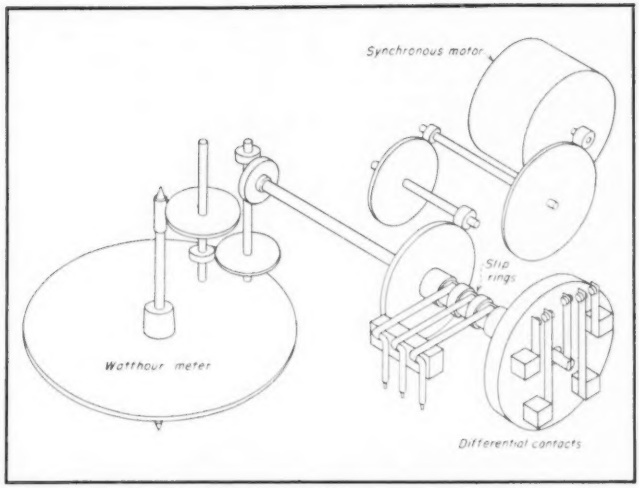

FIG 3—AUTOMATIC load holding control element based on differential action of contact-bearing disk driven by synchronous motor and contacting arm driven by watthour meter

System Stability

The addition or subtraction of the 10% increment of load when corrective action is taken by the load holder serves a dual purpose. By immediately over-correcting the load it prevents the integrated error from exceeding 500 wattseconds and at the same time stabilizes the system which, if the load control variac alone were used to correct load, would be highly unstable.

The adjustment of the load control variac, in turn, however, tends to follow load drifts, and thereby reduces the frequency of operation of the contacts.

Performance Results

The original installation of this type of automatic load control was made in 1940 and has been in constant use since that time. Subsequent installations have differed from the original only in details. Maintenance of the equipment as a whole has been almost negligible with the exception of wear of the pilot relays; this particular problem appears to be a function of the relay design rather than general design of the equipment as a whole and it is expected that a satisfactory solution to the problem by the relay manufacturer will be available in the near future.

While no exhaustive comparison of this method of load control with other automatic types is available, experience in the engineering department with a system based on the use of a contact-making dynamometer type wattmeter has indicated that this latter equipment requires considerably more attention, both during test and as maintenance, than does the factory control equipment. On the other hand, automatic load control, based on a contact-making Kelvin balance wattmeter, has been employed successfully for factory testing of Lincoln thermal demand meters in Canada for some years. The use of one of the various types of automatic voltage regulating transformers or electronic voltage regulators would, it is felt, be a valuable adjunct to manual load holding, but, of itself, can not be considered as a fully automatic system since the load would be subject to drifting as circuit impedances change with load or temperature.

Coordination of Distribution Protection

IV—Lightning and Transformer Protection

Fundamental considerations in selection and application of lightning protective devices to distribution circuits. Two philosophies of distribution transformer protection compared, evaluated. Problems of protection with banked secondaries. Conclusion of series.

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LIGHTNING PROTECTION for distribution circuits usually consists of three fundamental elements:

1. A surge voltage measuring device that acts to close a high-speed by-pass when surge voltage exceeds a predetermined amount.

2. The high-speed by-pass or short circuiting element.

3. Some means of opening the by-pass circuit after the surge has passed.

Because all of these elements may not be incorporated in the lightning protective device itself, and because the time intervals to close and open the high-speed element are not the same for all schemes, the details of lightning protection become important in the coordination picture.

Three types of lightning protective devices are in general use: (1) Plain spill gaps, (2) expulsion gaps or arresters (3) valve arresters. All of these devices combine the voltage measuring and high speed short circuiting elements in some form of spark gap. Differences, other than those in the surge break-down valves, lie in the means of opening and time of opening the "by-pass circuit". These are compared in Table I.

Table I shows that where plain spill gaps are used for lightning protection some means for rapidly opening and reclosing the circuit must be provided. This can be nicely handled by a selective fuse breaker coordination scheme or by any means of rapid opening and reclosing such as repeating fuses, automatic circuit reclosers or automatic reclosing circuit breakers.

TABLE I—Comparison of Lightning Protective Devices

Item	Plain Spill Gap	Expulsion Arrester	Valve Arrester
Means of opening high speed by-pass element	None	Expulsion Action	Voltage Sensitive Non-Linear Resistor
60-cycle ground fault current	Yes	Yes	No
Time to open high speed by-pass element		0 to 1 cycle	Duration of Excessive Voltage

TABLE II—Characteristics of Lightning Protective Devices

Plain Spill Gaps	Expulsion Arresters	Valve Arrester
Non-self-clearing	Self-clearing	Self-clearing
Stopping power follow usually depends upon circuit switching	0 to 1-cycle power follow	No power follow
Restoring service	Minimum power follow current	Must be and remain hermetically sealed
Birds	Erosion	Surge current limitations
Gap erosion	Surge current limitations	Total Cost
Control of gasses particularly if arc is permitted to last for more than say 8 or 10 cycles	Charging and leakage currents	
Total cost	Moisture Total cost	

Expulsion arresters function similarly to plain spill gaps except that after the gap spills over, the resultant 60-cycle power arc, because of contact with deionizing materials, generates a large amount of gas which acts like an expulsion fuse to "blow out" the arc. But, the 60-cycle ground fault current that flows for say 0 to 1 cycles may trip instantaneous over-current devices. An obvious remedy is to insert about 2-cycles delay in the instantaneous trip circuit. Further, if expulsion arrester 60-cycle ground fault current flows through small fuses it may damage the link possibly causing rupture. In this case the correct place for the lightning protective device is on the line side of transformer fuse.

It is outside the scope of this paper to discuss all of the problems incident to each type of lightning protection. However, some of the salient points which should be considered are given in Table II.

Within practical operating limits, the protection afforded distribution equipment by each of the listed types when properly applied can be taken as equally effective for lightning surges usually encountered.

Transformer Protection

Where lightning occurs frequently, protection against abnormal surge voltage is perhaps the most necessary distribution transformer protection. However, not all parts of the country have the same amount of lightning. Some areas, notably much of the west coast, find no economic justification for self-clearing lightning protection. There are border line areas, where economic justification for lightning protection seldom indicates more than plain spill gaps for distribution transformers.

Where lightning protective devices are used the protective device ground wire should be connected to the multi-grounded common neutral wire

Based on paper by author before University of Texas "Power Distribution Conference".

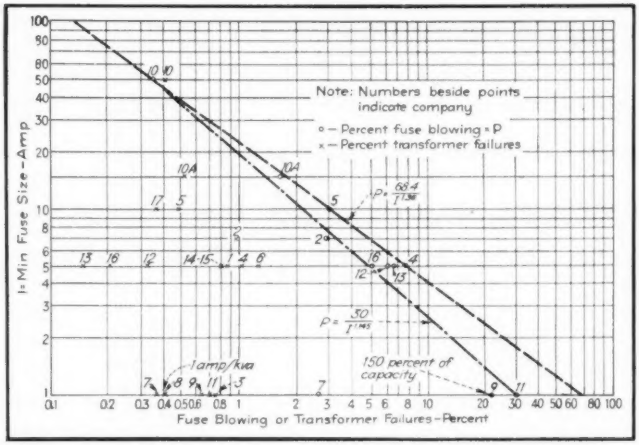

Note: Numbers beside points indicate company
o – Percent fuse blowing = P
x – Percent transformer failures
I = Min Fuse Size - Amp
Fuse Blowing or Transformer Failures - Percent
P = 68.4 / I^1.36
P = 50 / I^1.145
1 amp/kva
150 percent of capacity

FIG 1—FUSE BLOWING RATE and transformer failure rate experienced by several companies using various minimum sizes of transformer fuse. Data from Pennsylvania Electric Assn member companies for period of one year

and the transformer tank (gapped by some companies).

Overload or over-current protection of the distribution transformer is a complex problem. Viewed from the primary side, there are two philosophies of protection: 1 Protect line from transformer and secondary faults. 2 protect transformer from secondary faults. ie transformer overload protection.

The first philosophy is derived from the fact that many transformer and secondary faults can be burned off if a large enough primary fuse is used. If the transformer or secondary fault does not burn off, the only protection justified is that needed to keep the primary line from being faulted by transformer failure. This results in a relatively large primary fuse. In many cases it dictates the use of some kind of secondary protection to keep secondary faults from damaging the transformer. Small primary fuses are frequently blown by surges. Use of large fuses usually reduces the number of blown fuses. Shown in Fig 1 is one year's experience of several companies using various minimum sizes of transformer fuse. It is probably indicative of results which can be obtained.

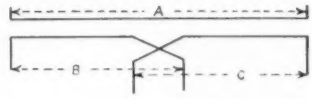
The second philosophy dictates use of a primary fuse, just enough larger than maximum expected load, to prevent undue fuse blowing and just below the damage curve of transformer. The only disadvantages of such a philosophy are: (1) That the fuse curve does not parallel the transformer heating curve. (2) small primary fuses unless especially designed may blow on surge currents, and (3) faults on the secondary may not produce enough primary current to blow the fuse.

The range of primary currents due to faults on the secondary of a distribution transformer is quite wide. It varies from a maximum value with 240-v faults, at transformer terminals, to a minimum value which occurs at the most distant customer with 120-v fault on meter. Shown in Fig 2 are the two impedance pictures for these extreme values. Note that for 120-v faults on 240-v winding, the transformer should be treated as a 3-winding unit. Typical impedances from which individual winding impedances can be computed are shown in Table III.

Referring again to Fig 2, note that a transformer primary fuse even when as small as 254% of transformer rating cannot protect the transformer against all secondary faults. Note how the transformer short time heating curve sweeps across the fuse characteristic. Similarly, if the secondary conductors are aerial cable, there is a problem of protecting the conductor insulation from thermal damage.

Roughly speaking, the characteristic of the primary fuse or secondary fuse has a slope of 2 on log paper and gradually changes its slope as the rate at which heat is transferred from the fusible link to adjacent metal parts and to air approaches the rate of heat release. The effect is to increase the slope of the characteristic curve until it reaches infinite time which usually is assumed in the

TABLE III—Winding Impedances of Typical Distribution Transformers



Inst. Plate Kva	A to B & C In Series			A to B or A to C		
	% IR	% IX	% IZ	% IR (1)	% IX (1)	% IZ (1)
A = 2,400 v B & C = 120 v each						
1½	2.45	.82	2.59	3.67	.99	3.80
3	1.95	1.06	2.22	2.92	1.27	3.18
5	1.83	1.33	2.27	2.74	1.60	3.16
7½	1.78	1.55	2.36	2.67	1.86	3.25
10	1.67	1.59	2.31	2.50	1.91	3.14
15	1.57	1.73	2.34	2.36	2.08	3.14
25	1.52	2.04	2.54	2.28	2.45	3.34
37½	1.30	2.64	2.94	1.95	3.17	3.72
50	1.10	2.08	2.36	1.65	2.50	3.00
75	1.19	2.82	3.06	1.79	3.38	3.82
100	1.12	3.0	3.21	1.68	3.60	3.98
150	1.03	4.35	4.48	1.55	5.25	5.45
200*	1.09	4.45	4.57	1.53	5.35	5.55
A = 7,620 v B & C = 120 v each						
1½	2.53	1.14	2.78	3.80	1.37	4.04
3	2.38	1.39	2.76	3.57	1.67	3.94
5	2.16	1.38	2.56	3.24	1.66	3.64
7½	2.04	1.67	2.63	3.06	2.00	3.66
10	1.75	1.59	2.36	2.62	1.91	3.24
15	1.63	1.60	2.29	2.44	1.92	3.10
25	1.58	2.00	2.54	2.37	2.40	3.36
37½	1.30	2.01	2.39	1.95	2.42	3.10
50	1.28	1.92	2.28	1.92	2.30	3.00
75	1.22	2.90	3.15	1.83	3.48	3.93
100	No tests available					
150	1.10	3.83	3.98	1.65	4.60	4.89
200	0.977	4.39	4.50	1.47	5.27	5.46
A = 14,400 v B & C = 120 v each						
3	No tests available					
5	2.30	1.10	2.54	3.45	1.32	3.69
10	2.04	1.31	2.42	3.06	1.57	3.45
15	1.76	1.69	2.44	2.64	2.03	3.32
25	1.5	1.83	2.37	2.25	2.20	3.14
37½	No tests available					
50	1.20	1.98	2.31	1.80	2.38	2.98
75	1.22	3.49	3.7	1.83	4.19	4.57
100	1.19	4.18	4.35	1.79	5.03	5.35
150	1.04	4.14	4.26	1.56	4.97	5.20
200*	1.06	4.58	4.70	1.59	5.50	5.73

(1) These values are based on instruction plate kva rating
* LV—120/240/480 tested on 480 V
Data from W E Co

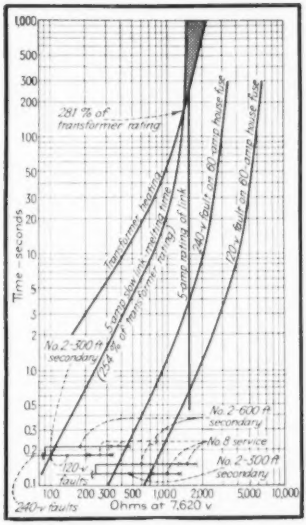


FIG 2—PRIMARY FUSING for 15-kva transformers, based on zero primary regulation. Note that a primary fuse as small as 254% of transformer rating cannot protect transformer against all secondary faults.

order of 1,000 sec at the rated current. From this it is evident that design of an inexpensive fuse which completely protects a transformer and does not restrict its load ability is a difficult problem to say the least. The "completely self-protected" transformer which is offered by several manufacturers' attempts to solve this problem by making use of a group of coordinated protective elements.

1. A primary fuse which opens with currents in the order of 800% of transformer rating

2. A secondary circuit breaker which:

(a) Functions partly by secondary current, and

(b) Partly by transformer oil temperature.

Such transformer over-current protection avoids serious transformer damage due to overloads. There is however some unavoidable loss of transformer life each time the secondary breaker opens on low current faults or over loads. One main objection to this form of protection is the fact that in some cases following severe overload, the transformer cannot be immediately returned to service, ie by immediately placing transformer back in service serious loss of insulation life and possibly burnout would occur. This poses the question—Which is to be saved—the load or the transformer?

Secondary Banking

If several single-phase secondary systems supplied by a common primary phase conductor be connected together to form a secondary bank, at least two highly desirable characteristics are obtained, namely: (1) Substantial reduction in flicker voltage effects at end of secondaries, (2) the load can often be carried when one transformer is out of service. Because of load diversity, this connection reduces the cost of load ability for equal voltage drop performance, compared to radial secondaries. But it does have a more complex overcurrent protection problem than is encountered on radial secondaries. In case a transformer is out of service, adjacent transformers not only feed their own secondaries, but also one-half the secondary that has no supply transformer. Hence subnormal voltage will occur under such conditions. *Now* if the secondary having no supply transformer is faulted, perhaps by its transformer, the impedance to the fault as viewed from an adjacent transformer is nearly double the impedance for radial operation as shown in Fig 3A. If the fault occurs at the radial end of secondary on an end transformer or on the primary side of an end transformer the situation is aggravated. Then the adjacent transformer must pick up the entire load of the transformer that is out of service. One common solution consists of connecting the various secondaries together through fuses whose size is a function of the smaller adjacent transformer as shown in Fig 3B.

One writer* on this subject suggests the following precautions when establishing such banks:

1. All transformers whose secondaries are to be interconnected in one secondary bank must be connected to the same phase of the primary circuit.

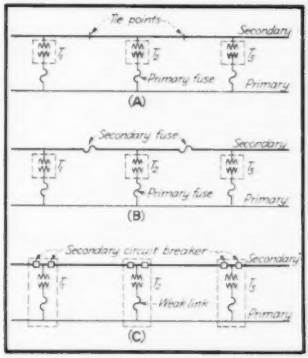


FIG 3—BANKED SECONDARY system (A) experiences subnormal voltage if one transformer is "out" and adjacent units must serve load of own secondary and ½ of one in trouble. One solution (B) is to connect secondaries through fuses sized to smaller adjacent transformer. Some transformers (C) have primary "weak link" protection and two secondary breakers, each, in effect, protecting secondary between transformers

2. There should be no more than one size difference between adjacent transformers.

3. Sectionalizing fuses should be selected to have a rating approximately equal to the ampere rating of the smallest adjacent transformer.

4. The size of the sectionalizing fuses should be checked from the standpoint of their ability to clear a line-to-neutral fault at the farther end of an adjacent secondary. This may require reducing the size of the sectionalizing fuse or shortening the length of secondary runs.

5. If possible, the sectionalizing fuse should be at least as large as the largest service-entrance fuse, and preferably one size larger.

A few transformers having both primary weak link protection and two secondary breakers have been installed on single phase banked secondaries as shown in Fig 3C. Each circuit breaker, in effect, protects the secondary between its transformer and the adjacent transformer. Chief advantage of this scheme is fact that

* "Banked Secondaries and Secondary Networks," by P E Brenner, *General Electric Review*," July 1940

all protection is packaged in transformer, consequently there is not the opportunity for error in size or location of fuses that exists in fused banks.

Protection of Meters

Modern single-phase meters used for residential metering are capable of carrying short time over loads of 350% of rating without thermal damage and with only slight accuracy impairment during the overload period. Thus, over-current protection of meters is not ordinarily considered a problem.

While the voltage magnitude of lightning surges on secondary conductors is seldom high enough to damage equipment, there are occasions when substantial surge currents may pass through meters. Such high unidirectional currents set up strong magnetic fields which may permanently affect strength of meter magnets. Recent meters avoid this difficulty by use of special magnetic materials, by copper plating the magnets or by placing conducting shields in critical places. One company reported adequate shielding by placing an aluminum cover over the usual glass cover. One manufacturer recently placed a small spill gap in the meter case which limits surge voltage across current and potential coils to values below insulation strength.

Interruptions to service having a duration in the range of $\frac{1}{4}$ to $\frac{3}{4}$ sec are objectionable only if a device stops when such an interruption occurs. Only two devices of such character are in common residential use today, ie some older varieties of fluorescent lamps and vapor lamps.

Customers having control equipment utilizing under voltage release feature can obtain the benefits of immediate reclosing when control devices are equipped to ride through the momentary lack of voltage. In the case of induction motors this can be obtained at moderate cost. For synchronous motors effective coordination usually involves opening the field circuit and in effect restarting the motor. This may involve removal of the load. Therefore, where the synchronous motor load is a substantial percentage of the circuit load, it is necessary to disconnect the synchronous motor immediately to prevent it from acting as a generator and sustaining an otherwise transient fault while the substation breaker is open.

Usually smaller induction motors, having magnetic starters, are in the majority. Some simple and inexpensive coordination methods are listed:

Three-Wire Control, Across-the-Line Magnetic Starters

1. *Line Fuse Overload Protection*
   Change push-button station to two-wire control and substitute a simple snap switch for the push-button station. When changing from three-wire to two-wire control be sure over-current or other protection is not lost. Alternative scheme—replace push-button station with time delay push-button station.
2. *Manual Reset Thermal Overload Protection*
   Same as Item 1 above.

Autotransformer Starting-Compensators

Change undervoltage release coil to time delay undervoltage release.

Present versions of mercury and sodium vapor lamps are quite susceptible to voltage dips and transient outages. With suitable ballast devices voltage dips reaching 70% of normal voltage do not cause the lamp to go out. Once the lamp is out it has to cool partially and then go through its starting cycle again.

Synchronous clocks are of two types—self-starting and manual starting. Both types are usually equipped with an indicator that appears when an interruption or severe drop in voltage occurs. Progress in the design of small synchronous motors is gradually eliminating non-self-starting clocks. Loss of time involved in immediate reclosure is negligible with self-starting clocks. The chief objection is the "red target".

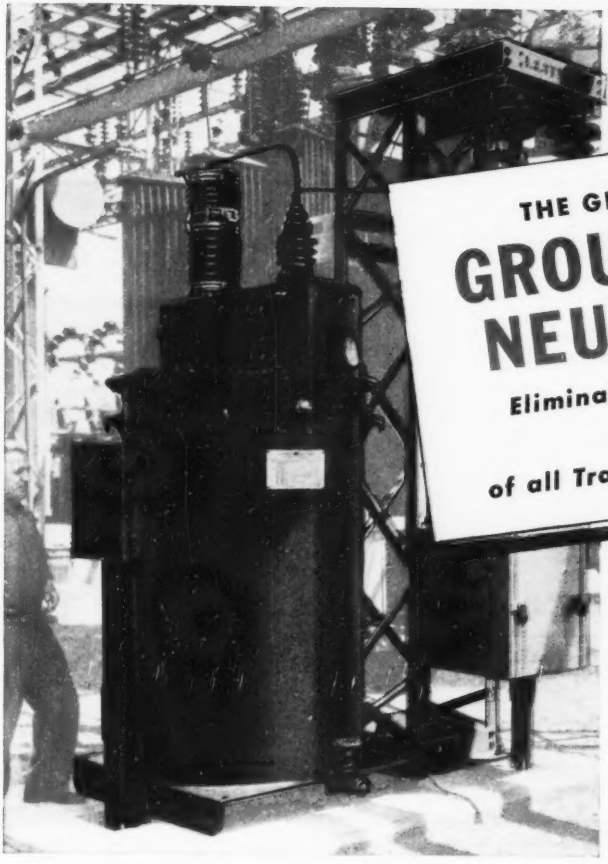
Ribbon Anode Developed for Cathodic Protection

For protecting buried metal structures from corrosion by means of cathodic protection, a ribbon type anode of magnesium has been developed by The Dow Chemical Co., Midland, Mich. This form of anode was designed for use primarily in high resistivity soils where cast anodes may not be practical because of the latter's low-current output under such conditions.

The new anode has a cross-section of $\frac{3}{4}$x$\frac{3}{4}$ in. and contains a centrally located core of iron wire to facilitate making permanent electrical connections and to prevent possible segregation. Because the elongated form presents a high area to weight ratio, the ribbon type anode is reported to supply from three to seven times as much current per pound of magnesium installed as does the conventional cast anode.

The magnesium ribbon can be installed very simply by using a wire-laying plow on which is mounted a reel of 1,000, 2,000 or 5,000 ft. of ribbon anode. The ribbon is installed in a furrow between 16 and 24 in. deep and is spaced between 2 to 10 ft from the structure to be protected. No chemical backfill is necessary and connections are made to such structures as pipelines about every 500 to 1,000 ft, where light current flows are expected. If larger current flows are expected, connections must be made at shorter intervals. Whether the ribbon anode is used alone or combined with cast magnesium anodes depends upon soil resistivity and uniformity.

The ribbon anode may also be used in very low resistance soils if the rapid polarization provided by the ribbon can justify itself in terms of reduced current demand. Another application is where protection of underwater structures is necessary.

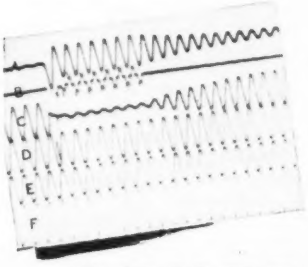


THE GENERAL ELECTRIC

GROUND-FAULT NEUTRALIZER

Eliminates Tripping Breakers on 50 to 80% of all Transmission System Faults

The ground-fault neutralizer is basically an oil-immersed reactor, insulated for line-to-neutral voltage, which is connected between the neutral of a transformer and ground. Its inductive reactance is tuned, by means of a motor-driven tap-changing switch, to approximately equal the capacitive reactance of the system. In the case of a transitory line-to-ground fault, the current passed by the reactor neutralizes the system charging currents from the two unfaulted phases. Any remaining current is small and is practically in phase with the line-to-neutral voltage. Since current and voltage reach zero almost simultaneously, the arc is extinguished without restriking—without an outage, and without even a momentary disturbance of line-to-line voltage.



The effectiveness of the ground-fault neutralizer is well shown by this oscillogram taken during a transitory ground fault on a 69-kv system. It shows how the arc was quenched after a few cycles, without restriking; system line-to-line voltages were not noticeably disturbed. A = neutralizer current, 26 amp. B = fault current, 10 amp. C = line-to-neutral voltage of faulted phase. D, E, and F = line-to-line voltages.

The General Electric ground-fault neutralizer is a protective device that quenches non-persistent line-to-ground faults in a few cycles and limits fault current to a few amperes. Thus, it prevents interruption of service during 50 to 80 per cent of all transmission system faults.

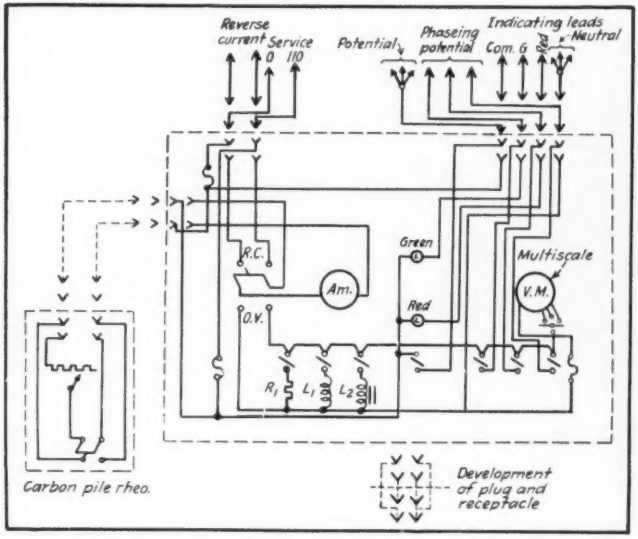
While this device has been well known in Europe for a great many years, it has only been recently that its many advantages have been widely recognized in this country. Compared to isolated-neutral systems, it eliminates high transient overvoltages that often result in flashovers at remote sections of the system. Compared to the solidly grounded system, it prevents service interruption, minimizes burning at the fault. Breaker operations are fewer, breaker maintenance is reduced.

In the belief that you will be interested in knowing more about the ground-fault neutralizer, we have revised our 16-page bulletin describing it. Ask your G-E sales representative for GEC-506, or write *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

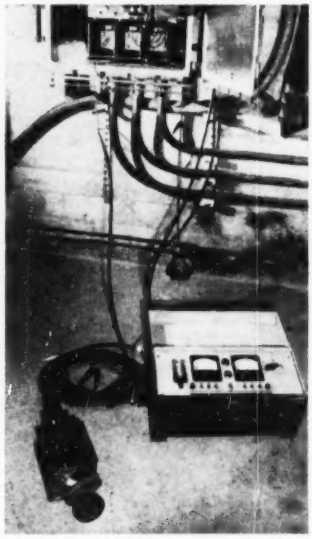
GENERAL ELECTRIC

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

Test Network Relays Twice as Fast



PHASE SHIFT of voltage is obtained in relay tester by resistor R_1, air core reactor L_1 and iron core reactor L_2 to obtain voltage phase shift required for complete test. Polarized connectors on all external connections minimize any chance of error in set up



PORTABLE TESTER, requires no changing of external connections when testing relays on underground network protectors

H. K. McCUTCHEON
Test Electrician
H. V. DOLDING
Test Electrician
Southern California Edison Co
Los Angeles, Calif.

SOUTHERN CALIFORNIA EDISON CO has constructed a portable test set for routine testing of master relays on underground network protectors. The set has reduced by 50% time required for testing these relays on Edison's Long Beach underground network.

The past three years have seen a rapid increase of network protector installations on the Long Beach system. Some simplified method of testing the relays upon installation and at routine periods was required to insure continuing satisfactory service without undue expenditure of man-hours. Study of the installation indicated that tests for over-voltage closing at unity, 70 and 90 deg phase angle, and a reverse current setting would satisfy operating requirements. The simplified test set shown above was designed to fulfill these requirements.

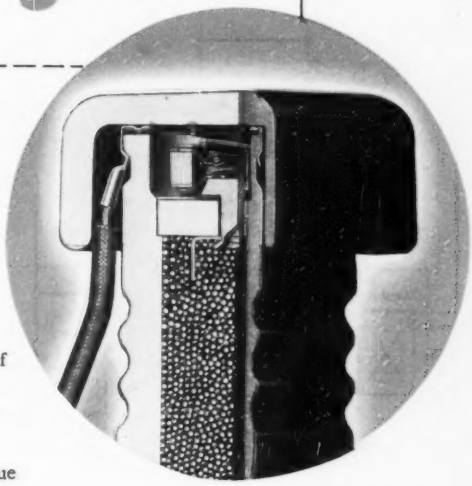
The set is built in a metal tool box lined with sponge rubber. It weighs 33 lb and is completely self-contained except for a carbon pile rheostat. It contains a one-ohm resistor for unity power factor tests, an air core reactor of approximately eight-ohms impedance for 70 deg lead voltage tests, and an iron core reactor of one-ohm impedance for 90 deg lead voltage tests. A hinged panel mounts a 10-amp ammeter, voltmeter, indicating lights and control switches. The multi-range voltmeter is 1,000 ohms per volt with 3, 15, and 150-v ranges. Red and green indicating lights show open and closed position of the master relay. Toggle switches on the panel allow for testing each relay element or all three in parallel. A double-pole, double-throw switch on the panel changes from over-voltage test connections to reverse current test connections without changing any leads externally.

Tests Within 1 Hr.

Connecting cables with polarized plugs are long enough so that tests may be made outside the vault, using telephone communication between test men. Whether the equipment is taken into the vault or not a routine test can be completed in less than an hour. This compares with nearly two hours by old methods. Compactness, direct readings, and elimination of time required to connect myriad component units previously used have made the difference.

Sealed-in Nitrogen

—one big reason why users prefer Pellet Arresters



Section of 3-kv pellet arrester, showing sealed N_2-filled gap chamber containing the series gap elements.

The G-E Pellet Arrester is the *only* distribution lightning arrester made today with dry nitrogen (N_2) sealed in the gap chamber. It's an *exclusive* G-E feature and your assurance of greater reliability over more years of operation. By preventing the formation of ozones and oxides, the dry, inert nitrogen keeps gap-electrodes bright as new and also stabilizes low sparkover characteristics.

G-E Pellet arresters are also distinguished by their unique valve material—lead dioxide pellets—which provides valve-action with *exceptionally low* IR drop—and which is unaffected by atmospheric moisture, condensation or humidity. These are reasons why the excellent protective characteristics of Pellet arresters *stay* excellent.

G-E Pellet Arresters limit lightning voltages to lower levels than any other distribution arrester—all ratings will easily withstand the AIEE-NEMA standard 65,000-ampere test—and they are applicable on <u>any</u> distribution system, urban or rural. For further details see your nearest G-E dealer or write for Bulletin GEA-2975. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

YOU BUY *BETTER* PROTECTION WHEN YOU BUY *PELLET* ARRESTERS!

THE QUALITY-STANDARD OF THE INDUSTRY FOR MORE THAN 25 YEARS

GENERAL ELECTRIC

Prevention of Voltage "Dips" Shutdowns

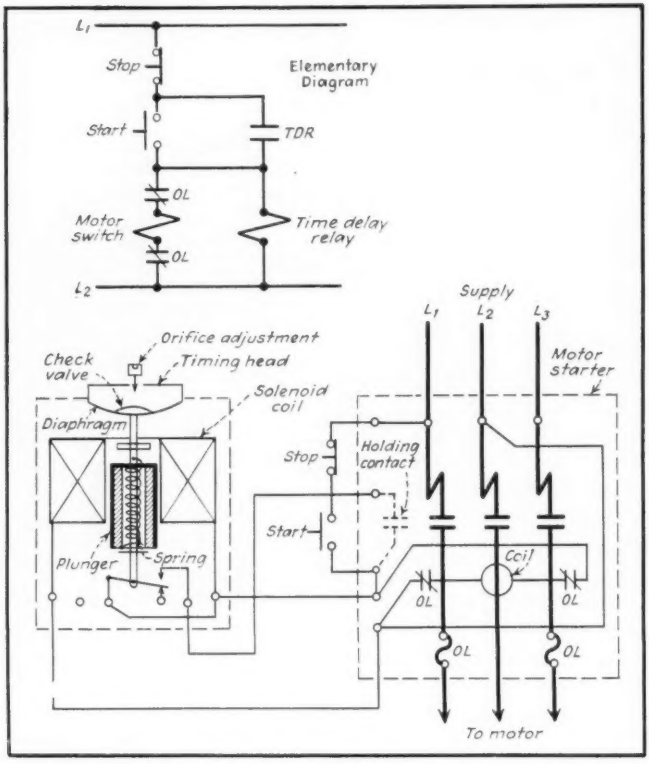


FIG 1—PNEUMATIC TIME-DELAY RELAY coordinated with motor starter in a paper mill protects against voltage dips

FRANK E. REEVES
Power Plant Design Engineer
Fay, Spofford & Thorndike
Boston, Mass.

SERVICE DROP-OUTS of motors and other electrical devices with no-voltage protection can be avoided by auxiliary equipment controlled by time-delay relays. Such designs are extremely reliable, even when "standing by" for long periods without being operated.

For example, the pneumatic time-delay relay scheme usually comprises a diaphragm type pneumatic operating head, solenoid, snap-action switch and terminal board. Depending on the sequence desired, the solenoid plunger loads a spring, either when the coil is energized or de-energized. The spring, acting on the diaphragm, slightly compresses the air above it, or creates a partial vacuum. Time delay is obtained by slow passage of the air through an adjustable orifice. When the diaphragm is flexed to the critical position, switch action occurs. If the switch is of the snap-action type, repeat accuracy is assured. A check valve in the diaphragm provides for instantaneous reset in the reverse direction. A special synthetic rubber type of resilient diaphragm avoids the weaknesses of older designs of relays due to drying out of the leather bellows. In some designs, a neoprene cap prevents dust from being drawn into the orifice and changing the timing.

Two recent applications of this type of control include a time-delay control (1) of an important motor drive such as in a paper mill; and (2) of auxiliary generating unit starting, to maintain service for incubator ventilation in poultry raising.

In the motor drive, the time-delay relay is arranged for delayed break as shown in Fig 1. It is connected to a standard across-the-line motor starter to protect against voltage dips. When the start button is pushed, the motor starter holding coil and the solenoid coil of the time-delay relay are energized, thus closing maximum contacts and starting the motor.

The relay's normally open contacts close and act as holding contacts for the motor starter. The starter's own holding contacts HC may be disconnected or allowed to remain in parallel with the relay's contacts as shown dotted in the wiring diagram. If the voltage dips enough to cause the motor starter to drop out, the starter will again pull-in as soon as nearly normal potential is reached. This is because the relay's contacts will not open until its coil has been de-energized for the full time period as previously determined by its setting.

To shut the motor down by manual push button, the stop button must remain depressed until the time period as set in the time-delay relay has expired. Otherwise the motor will start when the stop button is released. Or if holding down the stop button is undesirable, a mechanically interlocked start-stop push button having a momentary "start" and maintained contact "stop" feature may be used. The time delay units are generally adjustable from a fraction of a second to five or more minutes.

For incubator service, the time-delay relay is used in conjunction with an automatic transfer switch for starting an auxiliary gasoline or Diesel engine-driven generator for emergency energy. The relay prevents repeated unnecessary use of the starting battery during periods of frequent system disturbances, such as in lightning storms. In a typical application on a chicken farm, electrically driven fans are used in brooders. Short outages of 5 min or less are unimportant, but a 15-min loss of power would result in the suffocation of thousands of baby chicks. Thus the time-delay relay was set to delay the starting of

This General Electric power connector can simplify your inventory by 63% to 83%

G-E Block Terminal Connector—Class A-2

Five General Electric power connectors of the type shown above will handle *all* the 22 conductor sizes listed in the table*. Compare this feature with other brands that usually *require a different connector for each conductor size.* You'll immediately realize how much G-E connectors can cut your stock costs by reducing the number of connectors required.

Here are other ways you can SAVE by using G-E connectors.

SAVE TIME No more stock room safaris hunting for odd-size connectors. When you stock General Electric connectors, you stock fewer connectors. Also, you save time in ordering—you don't have to search through bulky catalogs looking for connectors that are seldom used and are a nuisance to order, besides taking up valuable stock space. G-E connectors are easy to order for the simple reason that you don't have to order so many varieties.

SAVE SPACE Less stock room space required when you use G-E connectors because fewer connectors are needed to take care of the same range of conductor sizes that you're using now.

SAVE MONEY When you use G-E connectors you reduce stock storage costs, and you save valuable time in ordering.

CHECK THESE ADDITIONAL FEATURES OF GENERAL ELECTRIC CONNECTORS

SILVER CONTACT SURFACES are a *standard* feature on *all* G-E connectors for use with copper conductors—at no extra cost. This eliminates oxidation problems, assures lower contact losses and longer life.

SERRATED CONTACT SURFACES give extremely high pull-out strength and a permanent, high-conductivity joint that will resist vibration and give positive pressure on the cable at all times.

NON-CORRODIBLE HARDWARE is of high-strength bronze alloy that gives tight and trouble-free service. G-E connectors will not twist, distort, or season crack.

INTERLOCKING SIDES confine the strands of the cable within the conductor enclosure, thus obtaining full advantage of the cable's current-carrying capacity.

Place an order today with your G-E sales representative and start realizing the many benefits to be gained by using this new line of General Electric connectors. Also, write for a copy of bulletin GEC-400 that contains 38 pages of valuable information on these new connectors, and see for yourself how easy they are to order. Write to *Apparatus Department, Section A856-51, General Electric Company, Schenectady 5, New York.*

*General Electric connectors come in a wide range of sizes and types—straight, tee, block, angle, parallel, expansion, ground, and many others. See bulletin GEC-400 for the complete line.

Conductor size	General Electric Catalog No.	Connector Mfg. A	Connector Mfg. B	Connector Mfg. C	Connector Mfg. D
1/0	61S1174-9	√	√	√	√
2/0	One G-E connector replaces 6; stock is reduced 83⅓%	√	√	√	√
3/0		√	√	\	√
4/0		√	\	\	√
250		√	\	\	√
300	↓	\	\	\	√
350	↑	\	\	\	√
400		√	None	\	None
500	61S1174-59	√	\	\	√
600		None	None	\	√
½ IPS	↓	√	None	\	√
700	↑	None	None	√	None
750		None	None	√	√
800	61S1174-88	None	None	\	√
1000		None	None	\	\
3/4 IPS	↓	√	\	\	√
1250	61S1174-118 One G-E connector replaces 3; stock is reduced 66⅔%	None	None	\	√
1500		None	None	√	√
1 IPS		None	None	√	√
1750	↑	None	None	\	√
2000	61S1174-148	None	None	\	\
1¼ IPS	↓	None	None	None	√
Only 5 G-E connectors for ALL 22 conductor sizes		11 connectors for 11 cond. sizes. No connectors available for 11 conductor sizes	9 connectors for 9 cond. sizes. No connectors available for 11 conductor sizes	21 different connectors for 21 cond. sizes	20 different connectors for 20 cond. sizes

\ Indicates a different connector.

GENERAL ELECTRIC

A856-51

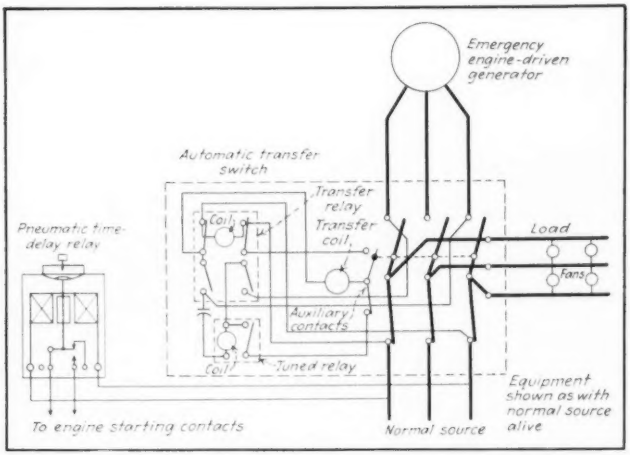
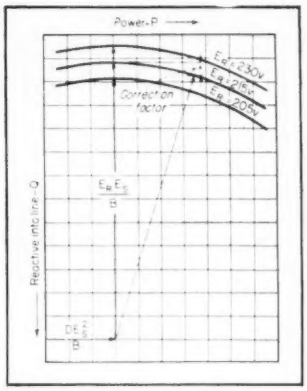


FIG 2—TIME-DELAY RELAY with electrically operated, mechanically held automatic transfer switch prevents emergency generating unit from starting until power has been off for a predetermined interval.

the emergency generator for 5 min.

In Fig 2, when normal supply fails, transfer switch contacts remain closed on normal side, but transfer relay drops out closing its lower contacts. Failure of supply also starts time-delay period. At end of period, if power is still off, time-delay relay contacts close, starting unit from a battery. When generator attains proper speed and voltage, a tuned relay pulls in, closing circuit to transfer coil which operates main contacts to transfer load to generator. If normal supply is restored before expiration of time-delay period, the time-delay relay instantaneously resets and unnecessary cranking of engine is avoided. Transfer coil of automatic transfer switch is energized only momentarily, the same coil being used for transfer in either direction. Switch has no neutral position.

Line Performance Charts Developed for 230 Kv



SENDING-END circle diagram for given line length and constant send.ng voltage Es

G. C. CONNER
System Studies Section
Bonneville Power Administration
Portland, Oregon

NEED for a labor-saving device to give the same information as the power circle diagram led to the development of line performance charts by the Bonneville Power Administration. Use of the charts saves considerable time and effort in obtaining results which are well within required accuracy limits.

Construction of the charts is based on properties of the power circle diagram. During investigation of 230-kv characteristics and construction of power circle diagrams it was found that the product of the abcissa of the center of the sending end circle, DE_s^2, B, and the length of line remained nearly constant for a wide range (up to 600 mile) of lengths. This constant is about 10,600 megawatt-miles for 795,000 cir mils ACSR, 34-ft equivalent spacing at 230 kv. Similar constants were found for other voltage classes. Knowing this constant, the abcissa of the sending circle (representing the real component of power sent) is easily obtained for any length of line.

The accompanying graph is a portion of a sending-end circle diagram for a particular length of line and constant sending voltage E_s. Three circles have been drawn for three different receiving-end voltages. Increasing voltage at one end of the line increases the radius of both circles in the diagram and moves the center at that end only away from the origin. Thus a vertical line through the center gives a point on each circle which represents the same value of real power but a value of reactive power corresponding to the particular receiver voltage.

From these values it is possible to plot a straight line graph of voltage drop (difference between sending and receiving voltages) vs sending-end reactive flow. After this is done for different line lengths, a family of straight line curves is obtained which is valid for various types of regulation and load flow studies.

For the general case a correction factor must be used to allow the straight line curves to be used over a wide range of voltage drop, line length and power flow. As shown on the graph, this correction is the difference between the full length of the power vector and its true vertical projection or actual reactive value. This correction factor has been calculated for E_s of 230 kv and E_r of 215 kv, therefore when it is used on any other receiver voltage a very small error is introduced.

One chart constructed, as described above, permits a quick and sufficiently accurate determination of voltage drop if the power and reactive flow at the generator end of the line is known. To obtain this power and reactive flow (receiver condition being known) a conventional chart is used to give net reactive power ($E^2Y—I^2X$) produced in the line. Both sets of curves are published in Engineering Reference Sheet 49-20 on p 94.

Hold-Closed

till the right fuse blows

a new concept in recloser operation!

G-E invites you to consider a different concept, the alternate operating function built into the FR-1 Recloser. Suppose a recloser, after its two instantaneous openings, HOLDS CLOSED *but only until the right fuse blows*—then automatically resets for instantaneous openings—ready to again clear temporary faults. What then?

FIRST— Fewer reclosers would be needed for complete protection. Where reclosers would ordinarily be required, you could use co-ordinating fuses instead.

SECOND— Fewer consumers would be affected by permanent faults, because the "hold-closed" function lets you use more co-ordinating fuses. You can break up a feeder into five, six or even more sections, each protected by a progressively smaller fuse. When the recloser holds-closed, it *forces* the *right fuse* to clear a permanent fault, thus confining outages to smaller areas.

THIRD— You can pick up the load after an outage without by-passing the recloser. No need to worry about inrush and motor starting currents because the recloser can't lock open—it holds closed, picks up the load, then automatically resets to normal position.

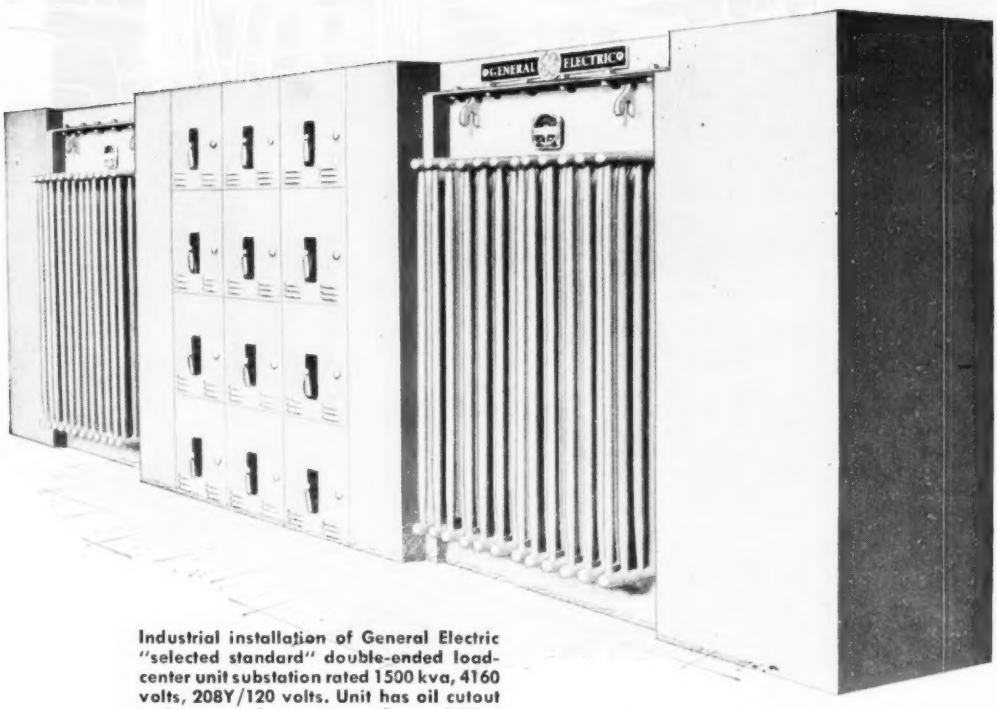
General Electric believes that on rural lines, this "hold-closed" function is the answer to lower cost protection, fewer outages per consumer and faster service restoration. Therefore, its new recloser, the FR-1, has been designed to embody this exclusive "hold-closed" function. Conversion from conventional operating function to "hold-closed" function can be made in the field. With this "hold-closed" function, the recloser opens twice instantaneously, each opening followed by a 1-second reclosing. This clears non-persistent fault without damage to fuses. If the fault is persistent, the recloser then ***holds closed***—but only long enough for the fuse to blow and clear the fault—whereupon the recloser quickly resets, ready to go again.

The FR-1 recloser can also be used with the conventional operating function—two instantaneous openings, plus two time-delay openings, to lock open. Because the time-delay openings are controlled by a highly accurate mechanical-escapement timer, operating in air, the FR-1 is not affected by temperature or condition of oil—thus permitting *reliable* year-round co-ordination with more ratings of fuses than any other conventional lock-open type of recloser. Because the FR-1 resets 5 times faster it gives more protection.

For the full story on the new "hold-closed" function, including complete application information, write for Bulletin GER-131. *Apparatus Department, General Electric Company, Schenectady 5, New York.*

GENERAL ELECTRIC

new load center unit



Industrial installation of General Electric "selected standard" double-ended load-center unit substation rated 1500 kva, 4160 volts, 208Y/120 volts. Unit has oil cutout in incoming line sections, Pyranol-filled transformers, and the new AK-1 air circuit breakers.

** Be sure to see the "More Power to America" full-color sound slidefilm "Modern Industrial Power Distribution." Ask your G-E sales representative to arrange a showing for your organization.*

substations

• improved appearance

Note the smooth, integrated appearance of these new G-E Pyranol® unit substations . . . no more gawky, "old-type" bus-duct connections between transformer and switchgear . . . now you can get the effortless flow of line and power that characterizes quality equipment for locations where appearance is a requisite.

• 'selected standards'

Based on surveyed demands of industry and proposed NEMA specifications, "selected standard" ratings have been inaugurated to bring you these efficient new load centers on shorter shipment. The most popular "selected standard" ratings are:

Low voltage—480△, 208Y/120 volts
High voltage—2.4, 4.16, 4.8, 12, 13.2, 13.8 kv
Kva ratings—300, 500, 750, 1000, 1500, 2000

Certain other "selected standard" load centers are available. Contact your G-E sales representative for further information.

• shorter shipments

By ordering "selected standards," you get really short shipments on Pyranol and dry-type load centers. Deliveries are in line with average plant construction schedules and it is suggested that load centers be ordered when construction begins.

• high impulse levels

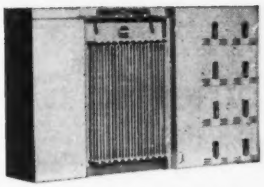
Pyranol unit substations with their inherently high impulse levels are particularly suitable for locations that are subject to switching surges and lightning.

Remember too, that G-E load-center power distribution is the most economical power distribution you can buy . . . no heavy, costly long-run feeders, no "piecemeal" purchases, no divided responsibility.

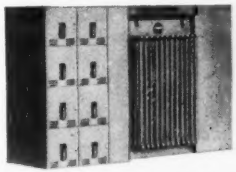
You'll save time too, because G-E "selected standard" load centers eliminate weeks spent over drawing boards detailing individual items; you'll save time because G-E factory-assembled unit substations are quickly and easily installed—in the center of the load area—with lower material and labor costs than required for "piecemeal" assemblies.

Ask your G-E sales representative *today* about how "selected standard" load centers can save time and money in your plant. Also, write for Bulletin GEA-3592.

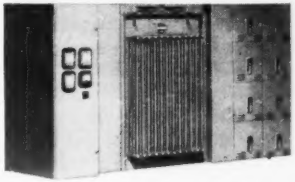
● *Apparatus Department, General Electric Company, Schenectady 5, New York.*



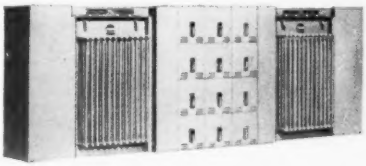
Typical 500 kva G-E "selected standard" load-center unit substation (standard arrangement). Unit consists of primary interrupter switch, liquid-filled transforming section, and low-voltage feeder switching section with the new Type AK-1 drawout breakers.



Same as unit shown above but with reversed arrangement.



Typical 500 kva G-E "selected standard" load-center unit substation with liquid-filled transforming section, metal-clad air power circuit breaker for incoming line-protection, and low-voltage feeder switching section with the new Type AK-1 drawout breakers.



G-E "selected standard" double-ended load-center unit substation rated 1500 kva with primary interrupter switches, liquid-filled transforming sections, and low-voltage feeder switching section with G-E Type AK-1 drawout air circuit breakers arranged for secondary selective service.

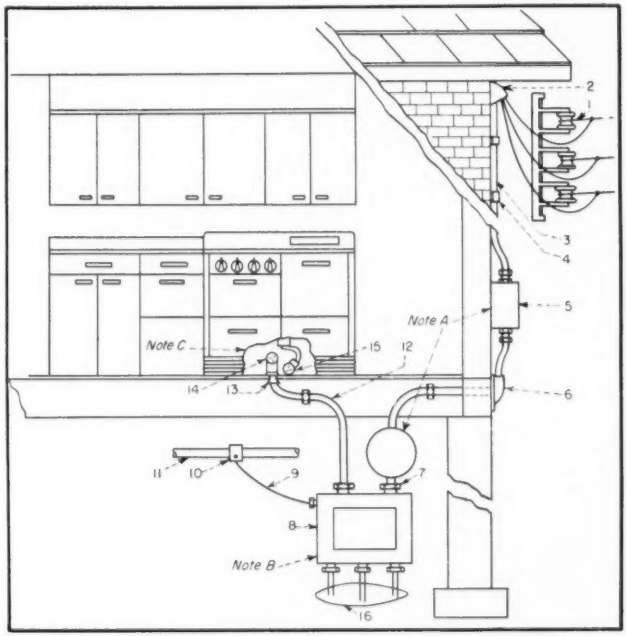
GENERAL ELECTRIC

Domestic Electric Range Wiring

For Connected Loads of 8.75 to 15 kw

PROVISIONS of the 1947 National Electrical Code which pertain to the application of various cable assemblies to range wiring are included in the table of material. Application of the provisions are illustrated in the drawing.

Unless an engineer, designer or an installation man is thoroughly familiar with the Code, it is difficult to determine whether all the applicable provisions in the Code are being considered. To obviate this difficulty the Engineering Department of National Electrical Manufacturers Association has prepared the drawing and material list with Code references.



Notes:

A. Outside or inside meter location dependent on requirement of power supplier.

B. Range circuit overcurrent protection, 40-amp fuses or 50-amp circuit breaker. Main and branch circuit fuses or circuit breakers are required.

C. Space provision for electrical connection at back of range to be minimum of 8 in. high x 6 in. wide x $5\frac{3}{4}$ in. deep.†

* NEMA Standard ER5-20
† NEMA Standard ER5-15

Material List

Item	Description	1947 N.E.C. Reference
1.	Service Drop	2301, 2303, 2304
2.	Service Head	2337
3.	Service Entrance Cable, Type SE, Style A or U	2304, 2305, 2331, 2332
4.	Service Entrance Cable Strap	2325, 2336
5.	Meter (by Power Supplier)	.....
6.	Sill Plate	.....
7.	Non-Watertight Connector	3004
8.	Service Equipment and Distribution Center	2351, 2371, 2372, 2435
9.	Grounding	2523, 2525-b, 2552, 2553, 2554, 2560 2591, 2592, 2594, 2595, 2599
10.	Ground Clamp or Fitting	2612 to 2617, incl.
11.	Ground, cold water service pipe	2581
	If cold water pipe not available	2582, 2583, 2584, 2586
12.	Service Entrance Cable, Type SE, Style A or U	2116-c-1, 2121-c-1, 3004, 3005
	Armored Cable, or Non-Metallic Sheathed Cable (Two No. 8 — one No. 10 Conductors)	Articles 334, 336 and 338
13.	Conduit or Bushing if Service Cable or Non-Metallic Sheathed Cable is used	3364-b
14.	3-Wire Outlet	4241-a
15.	3-Wire Range Cord Set* (Two No. 8 — one No. 10 Conductors)	2560, 4241-a
16.	Lighting and Appliance Circuits	2115-a and b

What's new in street lighting

Here's a Better Way

TO SUPPORT OPTICAL ASSEMBLIES FROM PORCELAIN INSULATORS

General Electric has now developed a new method of supporting optical assemblies for Forms 72 and 45H7 insulators. This new method—a single clamp collar held by one screw—eliminates holes through the porcelain, six screws and an L-shaped bracket. This new collar fits over the lower bead of the porcelain and clamps over the reflector or reflector support holding it against the bottom edge of the insulator. A single screw draws the collar tight.

Here are the main advantages:

Resiliency and Virtually Unlimited Life. Collar is high-quality stainless steel.

Quicker Installation or Replacement—Installing or removing reflector support requires loosening of one screw instead of removing three to six. Eliminates the necessity of gasketing screw holes in porcelain.

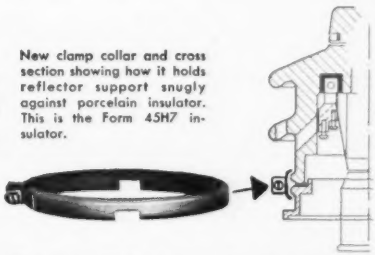
360° Orientation—Reflector support and its reflector can be positioned to any angle with respect to the insulator. Simplifies corner installations.

Stronger—Pressure evenly distributed around periphery of porcelain rather than at three screw holes.

Better Insulation—By eliminating screws through porcelain and internal hardware, electrical design is improved.

Standardization—Clamp collar is interchangeable on Forms 72 and 45H7, either new or existing. Same clamp collar holds reflector support for enclosed Types S, D, and VR optical assemblies, support for *small* enclosed Types CR and CS suburban units, and open Types SO and RW reflectors.

Mr. R. E. Clisdell, street-lighting specialist of the New York City Sales Office, points to the single screw that holds the new stainless steel clamp collar to the porcelain. This is the Form 72 luminaire with Type R reflector-refractor optical assembly.



New clamp collar and cross section showing how it holds reflector support snugly against porcelain insulator. This is the Form 45H7 insulator.

This new G-E clamp collar is one of the many improvements which General Electric has developed for better street lighting. For additional information on this new G-E clamp collar, call your Apparatus Office or write *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

GENERAL ELECTRIC

Are you tying in with the NEMA plan to give America better street lighting?

Simplified Line Performance Charts

G. C. CONNER System Studies Section
Bonneville Power Administration
Portland, Oregon

CHARTS PROVIDE a graphical method to facilitate determination of voltage regulation and line losses. Data are used as average values (average line kilovolts and average megavolt-amperes). A typical problem illustrates use of the charts.

Given:

(a) 150 miles of standard 230-kv line (500,000 cir mil copper equivalent ACSR, 34-ft equivalent delta spacing).
(b) Sending voltage $E_s = 230$ kv
(c) Receiving power $P_r = 140$ Mw, and receiving reactive component $Q_r = -5$ Mvar (lagging)

Find:

(a) Sending power P_s and sending reactive component Q_s
(b) Receiving voltage E_r

Solution:

Step I—Estimate receiver voltage and receiver load-amperes
Take $E_r = 210$ kv, load $\leqq 140$ Mva

$$\text{Then average voltage} = \frac{230 + 210}{2} = 220 \text{ kv}$$

Step II—Use Chart II. Opposite 140 Mva load on 220-kv curve, find -8.5 Mvar (lag) generated per 100 mi

$$\text{Reactive generated in 150-mi line} = (-8.5)\frac{150 \text{ mi}}{100} = -13 \text{ Mvar}$$

$$\text{Then } Q_s = Q_{line} + Q_r = (-13) + (-5) = -18 \text{ Mvar}$$

Step III—Calculate megawatt-miles of line
140 Mw × 150 mi = 21,000 Mw-mi
Use Chart I correction curve. Opposite 21,000 Mw-mi on 150 mi curve, find correction factor = −6 Mvar
The value of Q_s to be used on Chart I (Q_s vs kv drop) is given by:
Q (Chart I) = Q_s (from Step II) − correction
= (−18) − (−6) = −12 Mvar

Step IV—Use Chart I (Q_s vs kv drop). Opposite Q_s (−12 Mvar from Step III) on 150-mi curve, find volts drop = 20 kv
Then $E_s = E_r$ − drop = 230 − 20 = 210 kv

The value of E just obtained should check with the value assumed in Step I. If it does not, correct the estimate and repeat the foregoing steps until it does. We now have E_r and Q_s (value calculated in Step II). The last step is to calculate P_s.

Step V—Solve for P_s

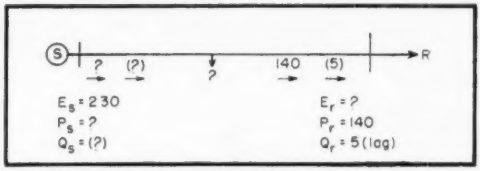
$$\text{Losses} = I^2R = \frac{(\text{Mva})^2}{(\text{kv}_r)^2} \times (R \text{ mi} \times \text{length}) \text{ approx.}$$

R mi $\leqq 0.117$ ohms (for 500,000 cir mil copper equivalent ACSR)

$$\text{Losses} = \frac{(110)^2}{(210)^2} \times (0.117 \times 150)$$

$$\leqq 8 \text{ Mw}$$

$P_s = P_r$ + losses
= 140 + 8 = 148 Mw



TYPICAL PROBLEM to determine sending power and reactive component, also receiving voltage

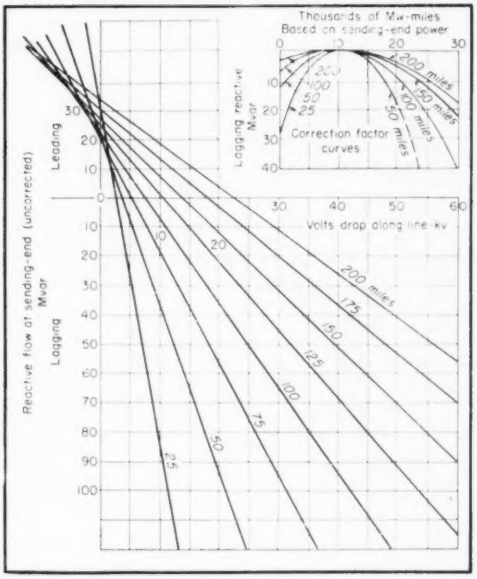


CHART I—REACTIVE FLOW at sending end of 230-kv steel-tower line, 500,000 cir mil copper equivalent, length 0-200 miles

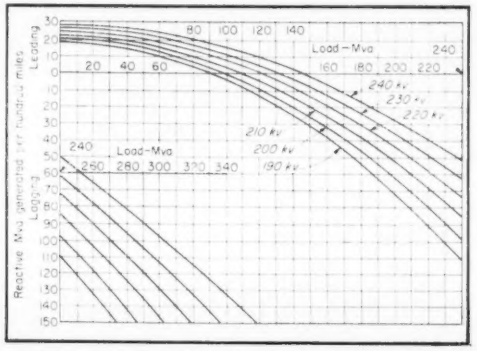
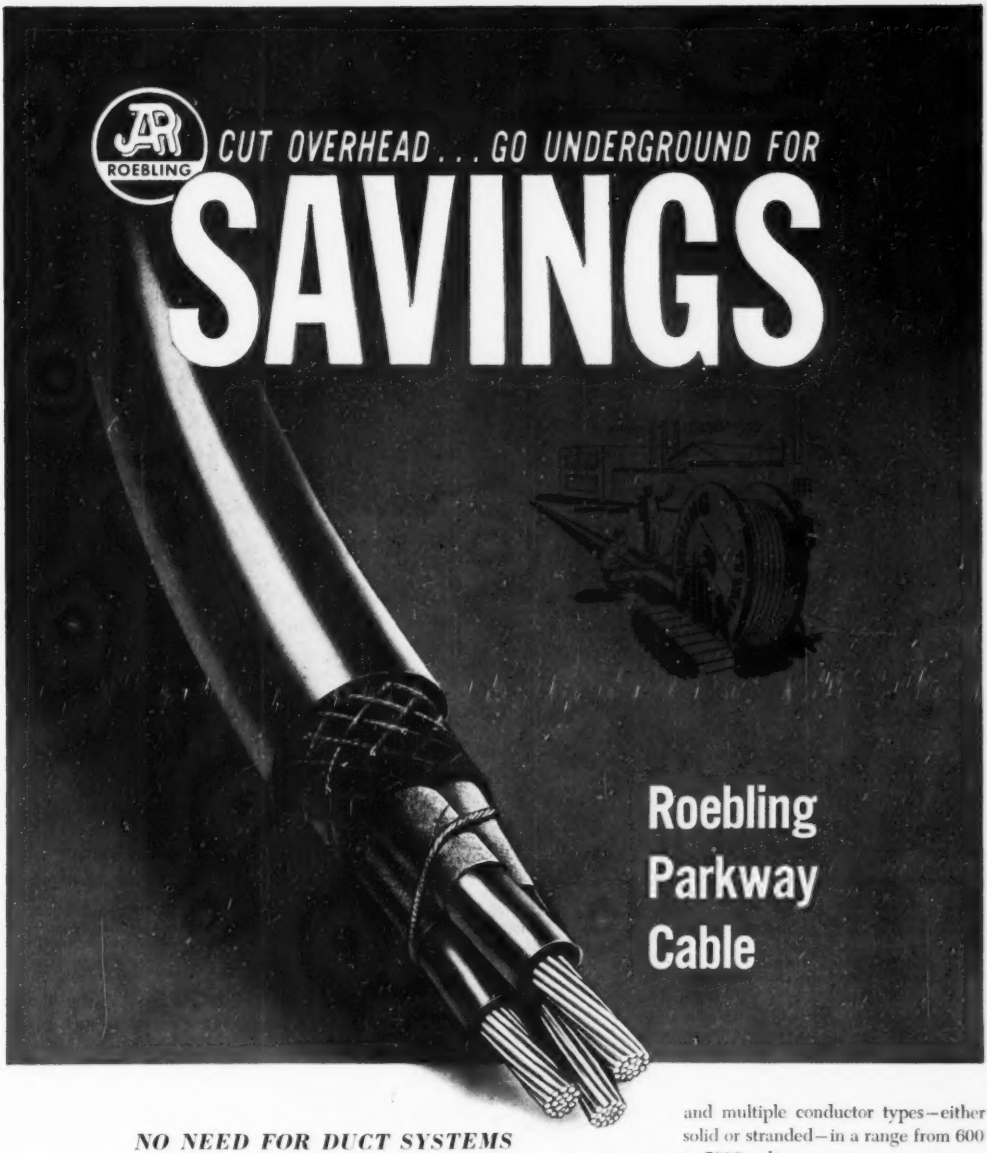


CHART II—REACTIVE POWER produced in 230-kv transmission lines, 795,000 cir mil ACSR, 34 ft equivalent delta spacing

For development of the charts see article entitled "Line Performance Charts Developed for 230 kv" published on p. 88.



NO NEED FOR DUCT SYSTEMS

ROEBLING PARKWAY CABLE is laid directly in the ground. No complicated and costly duct systems . . . a trench only two or three feet deep is ample and economical. Once installed, you can count on Roebling Parkway for trouble-free and uninterrupted service.

You have the choice of Roebling Parkway Cable with metallic armor or with a non-metallic, neoprene sheath that affords dependable physical protection. Both can be supplied in single and multiple conductor types—either solid or stranded—in a range from 600 to 5000 volts.

Your nearest Roebling distributor or Roebling office will be glad to help you select the best cable for your particular requirements. Call on them for any desired assistance. John A. Roebling's Sons Company, Trenton 2, New Jersey.

WRITE OR CALL THE ROEBLING FIELD MAN AT YOUR NEAREST ROEBLING OFFICE AND WAREHOUSE

Atlanta, 934 Avon Ave. ★ *Boston*, 51 Sleeper St. ★ *Chicago*, 5525 W. Roosevelt Rd. ★ *Cleveland*, 701 St. Clair Ave., N. E. ★ *Denver*, 1635 17th St. ★ *Houston*, 6216 Navigation Blvd. ★ *Los Angeles*, 216 S. Alameda St. ★ *New York*, 19 Rector St. ★ *Philadelphia*, 12 S. 12th St. ★ *Pittsburgh*, 355 W. North Ave. ★ *Portland, Ore.*, 1032 N. W. 14th Ave. ★ *San Francisco*, 1740 17th St. ★ *Seattle*, 900 First Ave.

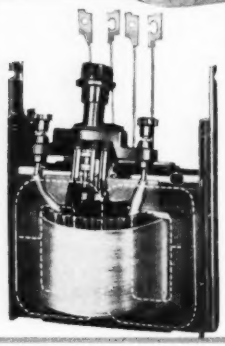
ROEBLING

☆ A CENTURY OF CONFIDENCE ☆

THE *NEW* MOLONEY *HiperCore** DISTRIBUTION TRANSFORMERS

*CORES MADE OF HIGH PERMEABILITY, ORIENTED, SILICON STEEL

BETTER VOLTAGE



Dotted line in illustration at left, indicate position of core in assembled core-and-coil unit. After cores are wound, they are annealed, impregnated and then cut into pairs of U-shaped pieces. Two large U-shaped pieces are placed side by side, forming an inner and two outer core legs. Then the windings are placed over the inner core leg. Next, the two matching U-shaped pieces are placed into position to complete the magnetic circuits. A thermo-setting adhesive bonds the core faces together.

BETTER VOLTAGE REGULATION AT ALL LOADS

Development of the new Moloney HiperCore Transformer has made possible a reduction in transformer impedance, resulting in better voltage regulation. These wound core transformers, being smaller physically, have inherently lower impedance than transformers of conventional core design.

Better voltage regulation means better all-around system performance. Secondary voltage fluctuations, due to sudden or intermittent load changes, are reduced. Secondary voltages may be maintained at a higher level resulting in improved performance of the connected load.

In many installations emergency loading is controlled largely by transformer voltage regulation. Moloney HiperCore Distribution Transformers, having better regulation, can carry higher overloads with the same permissible voltage drop.

MOLONEY

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT

GREATER SHORT-TIME OVERLOAD CAPACITY

Moloney HiperCore Transformers have improved short-time overload characteristics which provide better peak load performance and longer life. Reduced coil mass, achieved through use of oriented steel cores, together with the extensive use of cooling ducts, results in more rapid cooling of the windings and in a lower hottest-spot temperature gradient.

LIGHTER WEIGHT

The 30% to 35% higher flux carrying capacity of the oriented core steel used in HiperCore Transformers makes possible the use of smaller cores and windings, with consequent reductions in the weights of steel, copper, oil, and other materials. HiperCore Transformers weigh 15% to 30% less than transformers having cores made of hot rolled steel, making them easier to handle and install.

SMALLER SIZE

Since the higher flux carrying capacity of oriented steel permits the use of smaller cores and windings, smaller tanks can be used. Reductions in size range up to 30%. HiperCore Transformers take up less space on the pole, in the storeroom, and on the line truck.

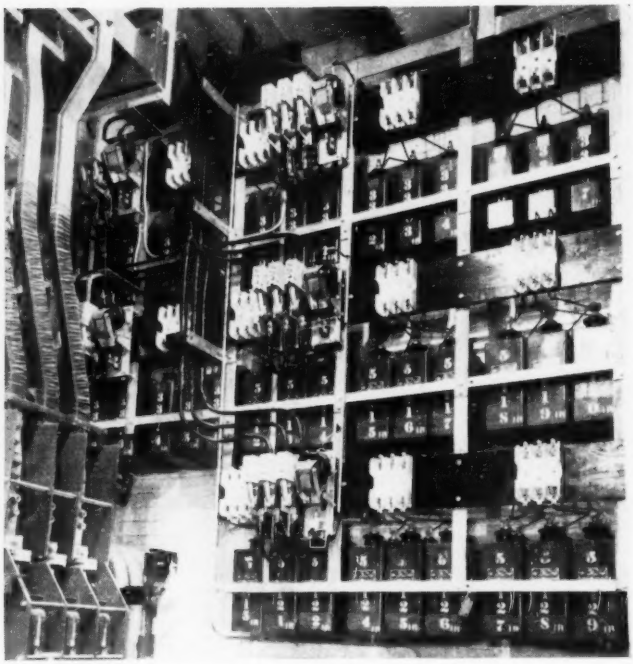
SUPERIOR TAP CHANGER DESIGN

The "snap action" movement of the tap changer used on Moloney HiperCore Transformers assures positive pressure at all times. The handle is above the hot oil level and the dial can be read from the handhole opening. The body of the tap changer is made of high-impact-strength phenolic resin for high insulation and elimination of breakage. Use of high contact pressure and oversize contact surfaces insures low temperature rise and eliminates pitting or burning.

ELECTRIC COMPANY

SAINT LOUIS 20, MISSOURI AND TORONTO, ONTARIO, CANADA

Low-Voltage Capacitors Economical on Secondary Networks



SECONDARY CAPACITORS in a-c secondary network are arranged in groups of nine 230-v, 7.5-kvar units switched by pilot-wire control from remote substations. Three banks of three units protected by three 100-amp fuses make up a group. Note contactors used in switching capacitor groups

WITHIN RECENT YEARS, decreasing power factors, and the more favorable relations between the cost of capacitors and the value of the system capacity released, has prompted studies of the economic merits of secondary capacitors on underground systems. Their installation in the underground low-voltage a-c network system of the Dallas Power and Light Co is one instance in which such application was found justified.

The accompanying picture shows a typical installation on the Dallas system. These capacitors are controlled in groups of nine 230-v, 7.5-kvar units arranged in banks of three units. Each bank is protected by three 100-amp fuses. The number of groups per underground transformer vault vary from one to seven.

The wire-unit groups are switched by pilot-wire control from a remote substation. Pilot-wire impulses actuate a 25-amp, 208-v multiple street lighting contactor in the vault which in turn controls 150-amp, 230-v three-pole contactors on each group of nine 7.5-kvar capacitors. About 80% of the 15,300 kvar to be installed by the end of 1949 on the Dallas network are to be controlled in this manner. The balance are permanently connected to the network during the peak load months, but are disconnected during the winter load period by removal of the fuses.

The economics of such applications of secondary capacitors are somewhat different than those encountered in overhead distribution (See ELECTRICAL WORLD, Feb 12, 1949 p 83). In underground systems it is difficult and costly to apply primary capacitors. The difference in capitalized value of system capacity released, as between primary and secondary capacitors, is considerable since it includes costly subway type transformers, network protectors and vaults that house this equipment. These considerations tend to favor the use of secondary rather than primary capacitors in low-voltage a-c network systems. In the past, however ,the relatively high power factor of many network systems and the very high cost of secondary capacitors, has until recently tended to discourage their application from the standpoint of overall economics.

Minimize Corrosion Of Control Devices

J. H. KINGHORN
Head of Relay and Protection Engineering Section
American Gas & Electric Service Corp
New York, N. Y.

CORROSION of control-circuit devices for generating station and substation equipment, particularly coils and resistors in closing and tripping circuits located in outdoor apparatus, is an occasional source of trouble. Such is the case in older stations which have not taken advantage of remedial methods. If the corrosion has reached the point of completely opening the circuit undetected, it can result in system troubles. The troubles can extend far beyond the particular piece of apparatus involved when the circuit is called upon to function.

Coil corrosion is fundamentally the action of electrolysis, as generally recognized in the electrical industry. Since tripping and closing coils were normally connected to the positive side of the station battery for many years, current in such circuits will flow from the coils to ground if an electrolytic path exists and corrosion results.

Less Electrolytic Effect

A number of steps have been taken to minimize this trouble. In the first place, corrosion was found particularly bad on coils on which an acid soldering flux had been used. The flux formed an electrolyte even without the deposit of moisture. This type of flux was eliminated from the manufacturing process. Next, larger size wire was used where space permitted. This of course does not stop corro-

It isn't what you GET...it's what you KEEP

...that makes the difference in station insulators!

While we would like you to think so, we can't honestly claim any difference between various makes of station insulators—*when new*. National standards and technical specifications make these insulators highly uniform, regardless of manufacture, and for excellent reasons. These standards can apply at only one time, however—fresh from production, before exposure to the elements or any other service conditions.

But, station insulators don't live "on the shelf." They must sustain extremes of heat and cold; sometimes following so closely as to constitute thermal shock. They are constantly under electrical stress. They receive severe mechanical strains and blows in switch operation. They are pulled and twisted by the expansion of the station framework. And, they are expected to perform under these conditions indefinitely. Here is where the *difference* in these insulators shows up!

Today, it is not unusual to find O-B station insulators wholly reliable after 30 years or more—just as capable of doing their job as the day they were built.

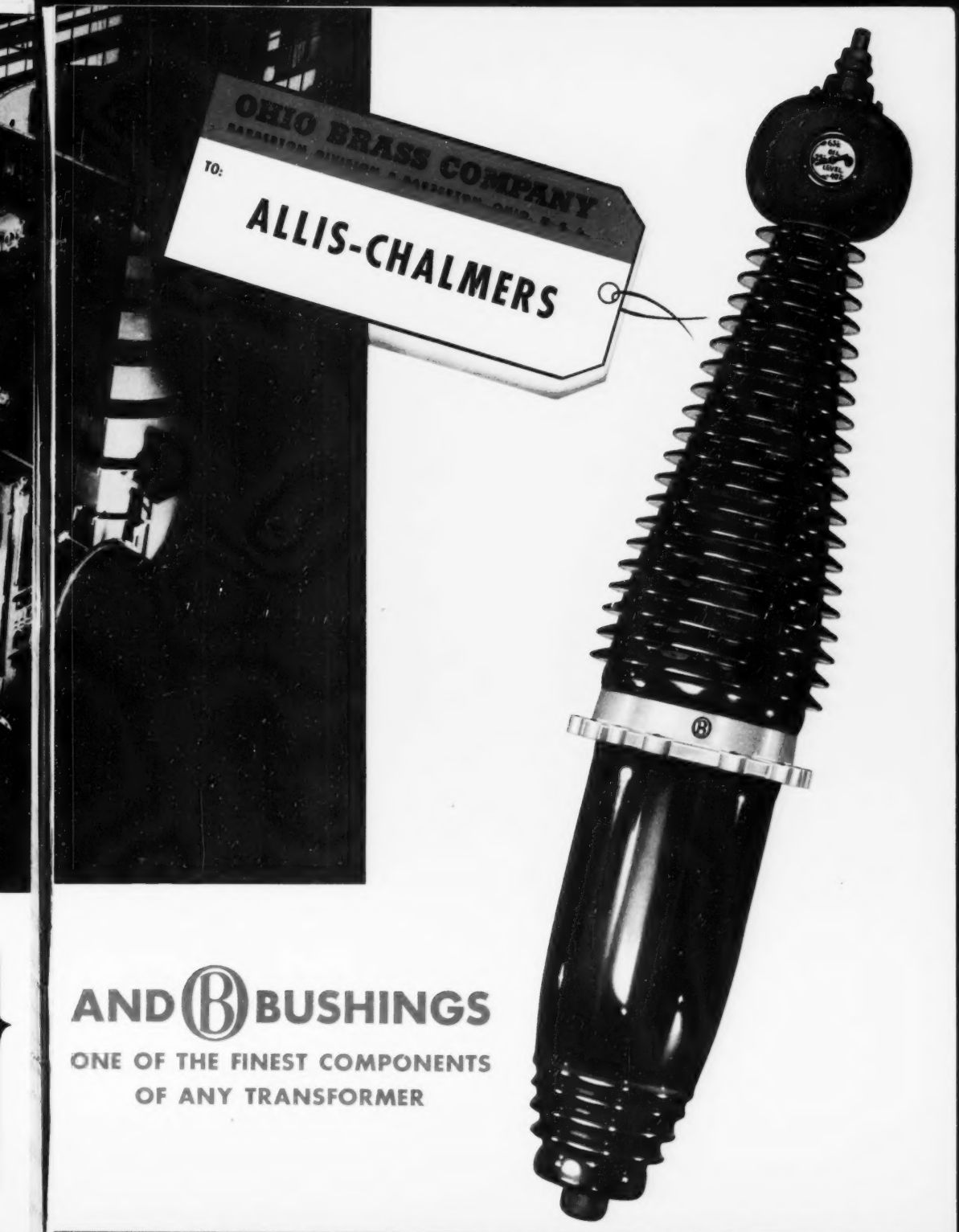
This is the big point of distinction in favor of O-B. All insulators start out very much alike, but O-B's have proved their ability to *retain* the standards that were originally put in them. When you insulate your stations with O-B, you have the satisfaction of knowing that what you get today, *you will still have* many years later. This *is* a difference, and a big one!

Ohio Brass

MANSFIELD, OHIO, U.S.A.

HI-TENSION NEWS *Junior*

● Closely approaching the physical size and weight limits of transportation facilities, this mammoth transformer has just been shipped after completion by the Allis-Chalmers Mfg. Co. While there may be no theoretical limit to the size of a transformer, practical restrictions of moving it from factory to its final location make this unit one of the largest that has been built, or can be built, today. Here are a few of the characteristics of this transformer which Allis-Chalmers points out . . . "Weight, stripped for shipment, 310,000 pounds. Oil capacity, 11,500 gallons. High voltage, 138 kv, grounded Y; low voltage, 69 kv, delta; tertiary voltage, 34½ kv, grounded Y. Output, 30,000 kva; capable of 40,000 kva with fan cooling. Equipped with load ratio control mechanism in neutral of high voltage winding to give plus or minus 10 per cent voltage regulation in sixteen 1¼ per cent steps. Other A-C features include rigidly braced and vacuum dried coils, controlled gasket compression, oil sealed Inert Gas oil preservation" . . .



AND (B) BUSHINGS

ONE OF THE FINEST COMPONENTS
OF ANY TRANSFORMER

HI-TENSION NEWS *Junior*

BOTH *Electrically* AND *Mechanically* O-B DEADENDS ARE THE STRONGEST POINTS IN A DISTRIBUTION LINE

Here is the answer to high mechanical and electrical strength in modern distribution deadends. THE INSULATOR—O-B's six-inch suspension unit. This insulator has strength to spare on even the toughest jobs. Still more important, it embodies all O-B factors of long life including vital resistance to thermal damage. Its high leakage and flashover ratings contribute to making it the strongest point in the line, electrically and mechanically. THE CLAMP—O-B Universal Strain Clamps develop the full rated ultimate strength of the conductor. This is done by a snubbing action that makes destructive jaw pressure unnecessary. Thus, strands are not weakened by severe deformation. Universal clamps install easily and quickly. There are no small parts to drop or no fine adjustments requiring bare hands. Each of the three models fits a wide range of cable sizes.

Go to Graybar for these O-B deadends. Variety and minimum stocks can be arranged so that this detail load is removed from your company store room; along with the many expenses involved. The Graybar Electric Company is prepared to make quick local delivery from nearly 100 nationally located warehouse stocks at regular prices, and save you both trouble and handling charges.

And remember—Graybar will be delivering the finest low voltage deadend "package" that *any amount* of money can buy, even though you pay no premium for O-B superiority.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

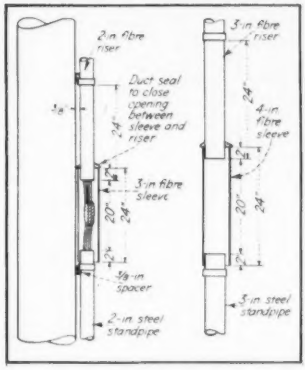
2973-M

sion, but merely postpones the time when the coil will become open-circuited. A further important improvement was the use of a cellulose-acetate insulation. That application eliminated almost all of the air spaces in the insulation, making it more nearly moisture-proof and to that extent removing the possibility of electrolysis occurring.

While there have been very few failures reported with coils having larger wire and with newer coils having cellulose-acetate impregnation, it is evident that the possibility is not completely eliminated.

A more direct method of eliminating electrolytic effects by reversing battery connections will be outlined in an ensuing issue.

Riser Joints Quickly Reached



FIBER SLEEVE ARRANGEMENT is used on pole risers to speed up access to joints between underground and upper conductors. Cut away section of sleeve joint on 2-in riser (left); Normal position of fiber sleeve on 3-in. riser (right)

JOSEPH E. GREENE
Distribution Department
Worcester County Electric Co
Worcester, Mass

TO SIMPLIFY ACCESS to conductor joints in runs up vertical stand-pipes, Worcester County Electric Co. utilizes fiber sleeves as shown. These sleeves are three inches in diameter when used on two-inch diameter standpipes and risers. On three-inch standpipes and risers fiber sleeves

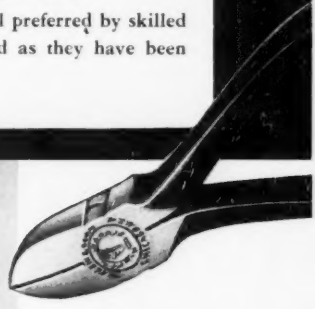
KLEINS
FOR MEN WHO WANT
the Best

• Ever since the first communication and power lines were strung, Klein Pliers have been the favorite tools of electrical workers.

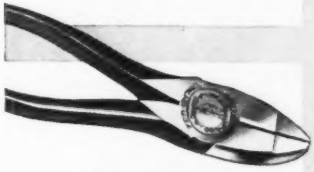
Today, Klein Pliers are made with the same exacting care that has won these tools their reputation for high quality.

Klein Pliers are still preferred by skilled workers in every field as they have been "since 1857."

No. 201. Original pattern husky Klein Side Cutting Plier. Square nose. Made in four sizes—6, 7, 8, and 9 inches.



No. 242. Klein Oblique Cutting Plier (heavy-duty pattern). A very useful tool that cuts close. Length, 6 inches.



No. 201 NE. The famous "streamlined" Klein Side Cutting Plier. Made in four sizes —6, 7, 8, and 9 inches.

No. 203. Klein Long Nose Plier. Long reach of jaws permits getting into difficult places. Made in 6 and 7-inch sizes.

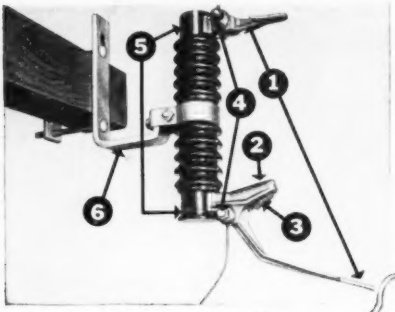
The Klein Pocket Tool Guide, showing the Klein line and containing useful tool information, will be mailed on request.

Established 1857

Mathias Established 1857 KLEIN & Sons Chicago, Ill., U.S.A.
1200 BELMONT AVE CHICAGO 18 ILL.

For Service Continuity...

CHANCE *Open Link* Cutout



7.5 KV-15 KV
50 AMPS.

1. The Chance Type EM Open Link Cutout is built to take rough handling and hard usage—to function smoothly, even after hundreds of repeated operations. *Sturdy Bronze Fittings* are used throughout.

2. *Protective Housing* covers the terminal separation spring to prevent ice and sleet from interfering with operation of spring.

3. *Terminal Spring* keeps fuse link under sufficient tension to insure proper contact and to separate terminals quickly when the link blows. It also absorbs the shock of overtravel, thus protecting the insulator. The spring is so located that tension cannot be overstressed in handling the cutout. It is also out of the current carrying path and the tension will not be affected by heavy current surges.

Safety Fuse Applicator

For extra protection when re-fusing all open link cutouts, Chance can furnish a fuse applicator with a transparent plastic shield that protects the operator in case the circuit is still shorted and the fuse blows.

4. *Pressure Type Conductor Terminals* are shaped to make four point line contact with any size jumper used. Nuts are secured with lock washers.

5. *Resilient Mounted Bronze Fittings* protect the porcelain insulators and reduce radio interference. The mounting bracket is cushioned by a soft metal band.

6. *Adjustable Mounting Bracket* will fit any size arm or may be attached to poles.

C492

ABC INDUSTRIES

You know it's RIGHT

A. B. CHANCE COMPANY—CENTRALIA, MO.

. . . and System Protection

CHANCE *Drop Out* Fuse Cutout

7.5 KV-15 KV
100 AMPS.

A Glance Tells the Story

OPERATED MANUALLY

BLOWN BY FAULT

The Chance Type KM Open Dropout Fuse Cutout gives you two outstanding advantages—plus many other features that contribute to more dependable service from electrical distribution systems.

POSITIVE INDICATION . . . A glance shows whether the cutout has been opened as a disconnect or blown. If the fuse tube is hanging from the lower contact housing, it has been opened manually. If the fuse tube is hanging from the upper housing of the cutout, the fuse link has been blown. *Only Chance Dropout Cutouts have this distinctive feature.*

DEPENDABLE OPERATION IN ALL KINDS OF WEATHER. All working parts, at both top and bottom of the cutout assembly, are shielded from ice accumulations. When the fuse link blows, the lower end of the fuse tube swings away from the lower contact, leaving the fuse tube suspended by its closed end. This prevents moisture from entering the fuse tube.

OTHER IMPORTANT FEATURES. When the fuse tube is moved into the closed position, fuse link is not subjected to shock or additional tension causing premature failure. Fuse tube is not subjected to compression stresses or warping when in the closed position.

Pressure contact springs are protected by over-travel stops and wipe contacts clean when fuse tube is installed.

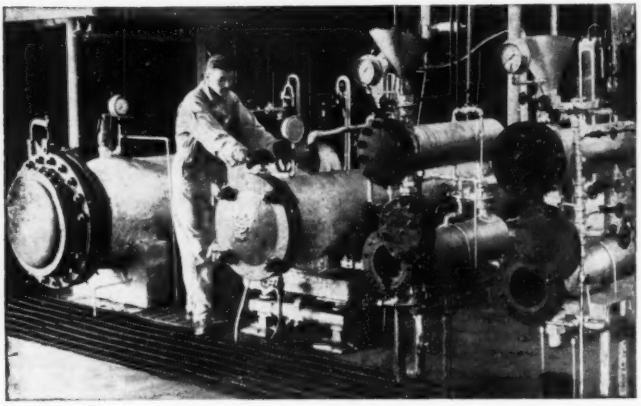
When the fuse link melts, the fuse link leader is quickly drawn out of the tube by an ejector arm which does not lose contact with the clip until it has completed its operation. This operation is delayed during short circuit, reducing the possibility of contact pitting.

Fuse tube may be provided with an attachment which will prevent the fuse leader being thrown from the cutout during a short circuit operation.

when you specify...

SAN FRANCISCO, CALIFORNIA

These experimental wood-treating cylinders vary in size from 2" x 12" to 4' x 20'. It is possible to make detailed studies ranging from test-tube quantities to semi-commercial quantities.



HOW KOPPERS FAMOUS TECHNICAL LABORATORY

helps improve serviceability of wood

The Koppers Technical Laboratory at Orrville, Ohio is one of the most complete wood-treating laboratories in the world. Here, Koppers experts, working with the best in modern equipment, lead the field in the development of improved wood-preservatives and techniques.

In addition to other research, the staff of this laboratory is constantly working on the following projects: a continuing study of pressure-treatment with creosote; the evaluation of all known treating materials; the development of new preservatives.

▸▸ How Koppers technical facilities can help you!

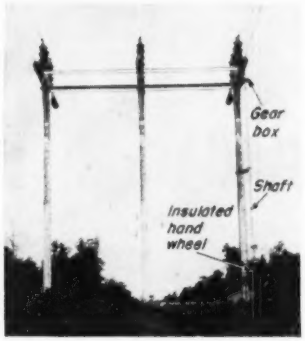
This famous Koppers Technical Laboratory is now equipped to handle your specific wood-treating problems. Its technical staff welcomes your inquiries, and will gladly recommend the *proper* technique of treatment . . . the *proper* type of preservative to meet your individual needs. Write for further information.

KOPPERS PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC., Pittsburgh 19, Pa.

four inches in diameter are required. The sleeves are 24 in. long overall. In application the riser is cut away for a length of 20 in. about the conductor joint and the opening between sleeve and riser closed by duct seal when the sleeve is placed in position. To reach the joint for testing or other purposes after it has been in service it is no longer necessary to break into the riser. By removing the duct seal (after taking off the usual clamps) the 24-in. length sleeve can be lifted about 22 in., exposing the joint as shown. It can then be put back in place and resealed.

Maintaining 110-Kv Switches and Fuses



SWITCH TROUBLES were reduced by slowing down speed of opening and closing

J. A. RAWLS
Supervisor
Electrical Equipment and Transmission
Virginia Electric and Power Co
Richmond, Va

ANALYSIS of difficulties with 110-kv air break switches, showed that most switch troubles were due to opening and closing them rapidly.

To overcome this, gear boxes were installed on most 110-kv switches, as shown. The gear boxes are located on elevation with switch bases to reduce the torsion in the vertical operating pipes. A 2 ft dia hand wheel is located at the bottom of the vertical operating pipe, which requires ap-

From a paper presented before an Engineering and Operators Conference of the Southeastern Electric Exchange

proximately 4½ complete turns to open or close a switch. Since installing gear boxes, troubles due to the breaking and bending of switch parts on opening and closing have disappeared. The high pressure contact switch has given good results. Similarly side opening type disconnects controlled by a gear box have given good service. Frequently two 3-phase sets are controlled by the same gear box.

In substations, a quarterly inspection schedule operates all air break and disconnect switches. This helps reduce friction due to corrosion.

A number of high voltage fuses are used to protect 110-kv power and potential transformers. The original high voltage fuses consisted of lead fuse wire inside of a long boiler gage glass tube which was filled with marble dust. These fuses had very little interrupting capacity and corona would eat the links in two, but they were as good as any fuse available 20 years ago. New high voltage fuses were tried as they were developed. But the open type fuses would deteriorate rapidly because of corona and the only dependable type was the liquid filled. Liquid filled fuses were satisfactory until troubles were encountered due to rapid recovery voltages which would break the glass tube whenever a fuse blew.

By working with the manufacturer, a corrugated tube was designed which has been very satisfactory. The corrugated tube liquid filled fuse is used where its interrupting capacity is sufficient. For higher capacities, recently several high interrupting capacity boric acid fuses were installed. No maintenance is required on the modern fuse except the regular inspection and replacement on a regular schedule whether the fuses have operated under fault or not.

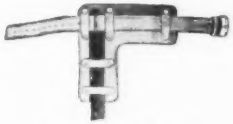
Correction

The article "Portable Work Platform Reaches Awkward Jobs" which appeared on page 85 of the April 9 issue stated that the mobile platform was developed by Boston Edison Co. This was in error since the platform was designed and built by the Atlas Industrial Corp. 849 39th St. New York, N. Y.

660 Distributors ready to supply you in a hurry!

Buckingham
LINEMAN'S SAFETY EQUIPMENT

"Prompt Service" — two words that mean what they say when you deal with a Buckingham distributor. Fully stocked and strategically located, he's usually in a position to rush your order through. And when you buy Buckingham, you buy the best. Fifty years' experience in quality production assures you safe, dependable, low-cost linemen's equipment.



Deluxe Climber Pad provides utmost in comfort. Made of high-grade leather, padded with rubberized wool and backed with chrome leather. Five other designs to choose from—fitted with pads of rubberized wool or felt, or without padding.

Patented Right and Left Climbers. Offset in shank bring gaff in alignment with wearer's balance when climbing — greatly overcomes tendency of climbers to twist and slide back on legs. Range of lengths from 14" to 19"; weights: medium, light, feather. Other styles available: Straight Pattern Climbers; Adjustable Climbers; Tree Climbers.

Buckingham Thread Cleaner. Removes rust, smooths-out flats, and reconditions threads of mutilated studs and bolts. Adjustable jaws follow the pitch of right- and left-hand threads with root diameters from ¼" to 2⁹⁄₁₆". Two sizes: ¼" to 1" root diam.; 1" to 2⁹⁄₁₆" root diam.

OTHER BUCKINGHAM EQUIPMENT
Adjustable Climbers
Tool Belts
Bags and Pouches
Safety Straps
Spur Protectors
Skinning Knives
Protecto Grips

WRITE for complete catalog and NEAREST distributor in your state

BUCKINGHAM MANUFACTURING CO., INC.
5-7 Travis Street Binghamton, N. Y.

LOAD BUILDING

Two Year Conversion of Rectified-Fluorescent Fixtures Handled by Two Electricians

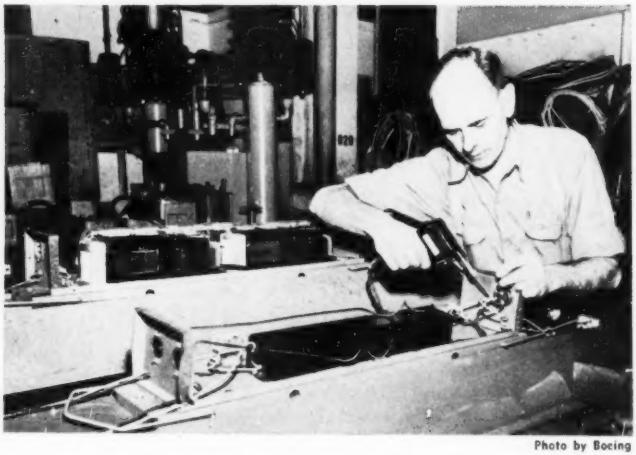


Photo by Boeing

RECTIFIED-FLUORESCENT FIXTURE being converted to standard fluorescent by replacing two transformers, other auxiliaries (rear), with a single ballast, changing and rewiring tube sockets (front). Boeing Airplane Co, Seattle, has two electricians on a two-year program to convert 2,200 of the old-type units. Program is prompted by workers' preference for the more natural light of standard fluorescents.

CONVERSION of old rectified-fluorescent lamp fixtures to standard fluorescent units can be accomplished efficiently in a large plant by a small maintenance force. Boeing Airplane Co has worked out a satisfactory program for converting 2,200 rectified fluorescent units in its Seattle plant, using only two electricians. Instead of buying complete new fixtures, new ballasts and tubes are installed in the old reflectors a few at a time. The complete job will be done by two men in about two years, working at a rate of 90 to 100 per month.

The two electricians take down about 15 old fixtures at a time, using either scaffolding or a ladder. A bar supporting a hoist is fastened to the vertical conduit supporting the fixture. The hoist lowers the old fixture by its hanger and lifts a converted fixture into place. Replacing 15 fixtures by this method requires about half a day.

The old fixtures are trucked to the plant's electrical maintenance shop, where tubes, rectifying auxiliaries and transformers are disassembled from seven or eight reflectors on a table at one time. Tubes are saved for replacement of those remaining in service, and the other items are sent to the salvage department.

Reflectors are cleaned in a soap solution in an 8 by 20-ft tank, and two holes are punched at each end for aluminum angle brackets which hold the tube sockets. They are then returned to the table for installation of ballasts as an assembly-line operation. Three lengths of wire, sockets and brackets are prepared in advance, 50 to 60 at a time, to be used as needed. The plug and cap from the old fixture are used again in the converted unit. By performing the operations on groups of seven or eight at a time, the two men have increased their output from two a day to four a day.

Light output of the new 85-w tubes will be the same as the old 85-w units, 4,000 lumens. They will draw only 13 amp per circuit of 12 compared to 19 amp for the rectified fixtures, the difference representing losses in rectification and old style ballasts. Replacing the two transformers and auxiliaries of the old unit by a single ballast reduces fixture weight by 20 lb. Although the new tubes give no more light than the old, workers prefer the daylight color compared to the intense blue light of the rectified units, according to C. S. Sargent, plant electrical engineer.

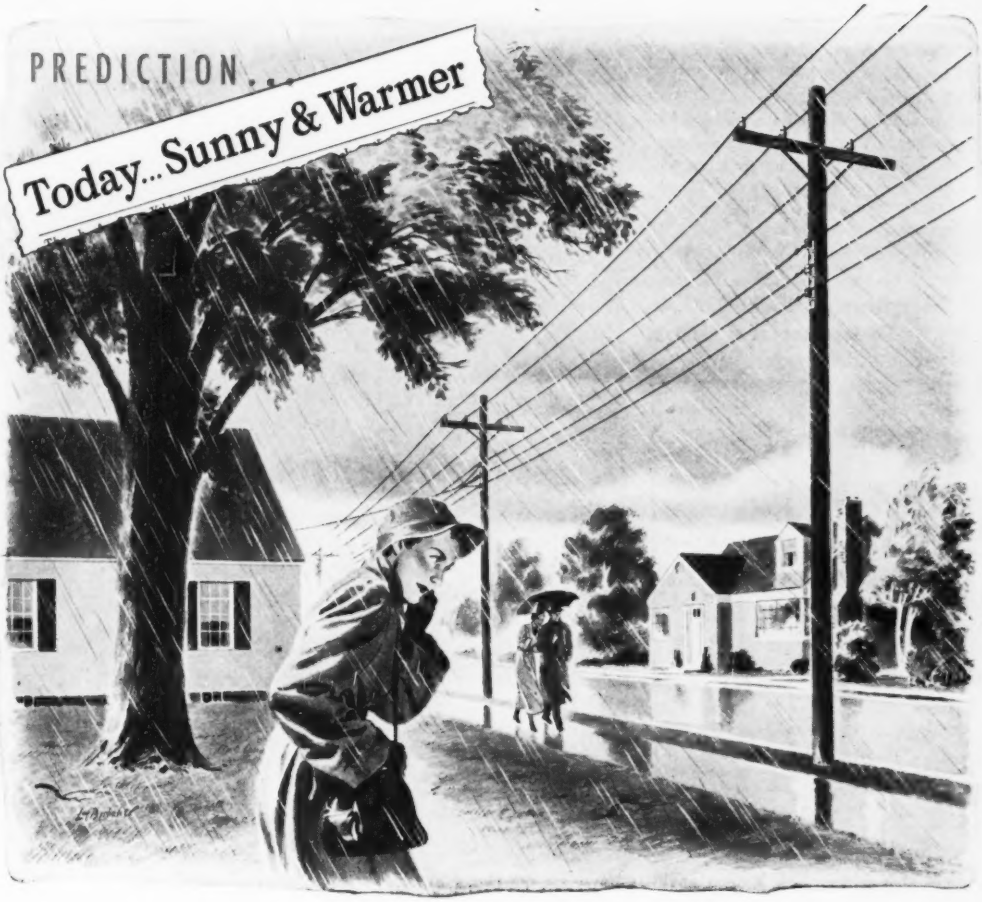
Electric Heat a "Natural" Here

B. W. DE PEW
General Electric Co
San Francisco, Cal.

LINT floating in the air ruled out open flame heating. The temperature required and the manner of heat application to the work would have made the use of steam difficult, to say the least. This job of "ironing" holding compound into jute felt mat was seen immediately as a "natural" for electric heat.

National Automotive Fibers, Inc, Oakland, Cal, produces floor mats for motor cars. The felted jute moves from the carding machines to a roll which applies the proper quantity of compound to one side. Then the heated roll irons the compound in.

The ironing roll is 48 in. in diameter and 92 in. long. Its surface must be held at an even temperature of 450 F. The difficulties of flame or



Duraline's Right when the weather's wrong

Anaconda's Duraline URC Weatherproof gives vastly improved performance during emergency periods.

Its interlocked, felted layers . . . combined with time-tried URC saturants and finishers . . . *prevent moisture penetration* and protect against outages caused by foreign objects contacting the lines. Unsightly "festoons" will never be seen along "Duralines."

Specify Duraline for protection during emergency periods of adverse weather . . . and through the years . . . at no extra cost. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

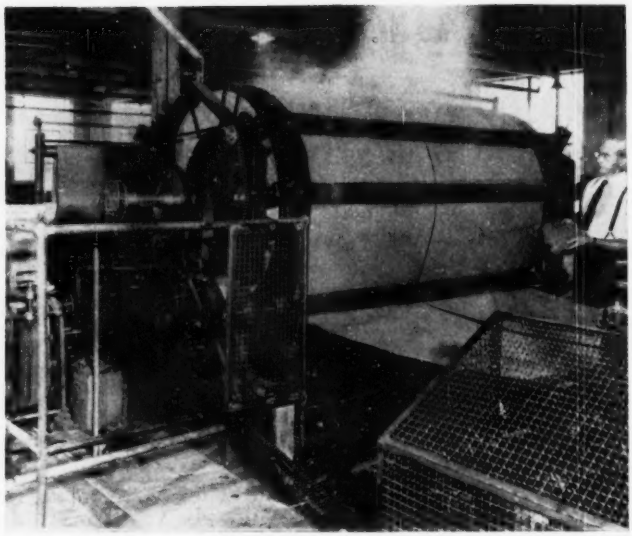
60417

ANACONDA
from mine to consumer

Duraline* URC WEATHERPROOF
*Reg. U. S. Pat. Off.

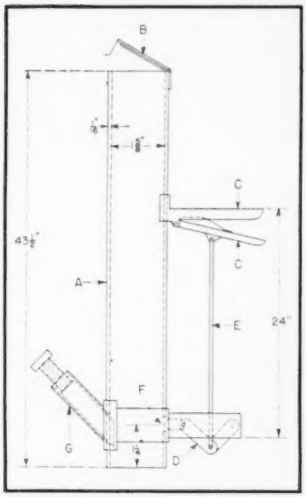
STAYS PUT!

steam heating are obvious. Electric heat is applied by 51 heating units 96 in. long clamped to the inside of the roll. The heaters are connected in balanced Y, 230 v, 3 phase and total 59.5 kw. Automatic temperature control is accomplished by a millivoltmeter pyrometer with thermocouple attached inside the roll.

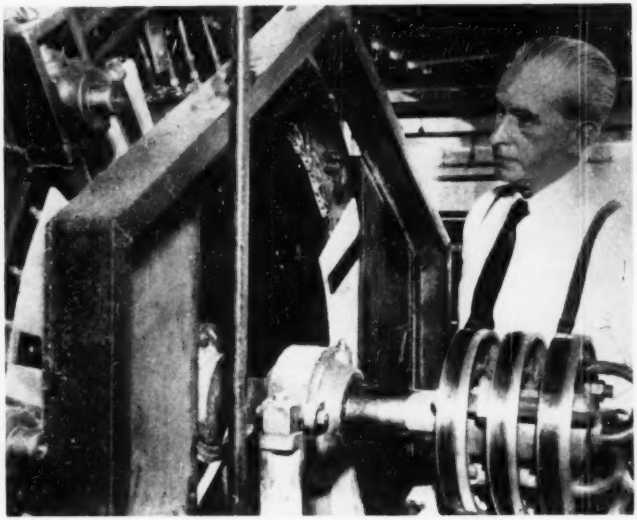


ELECTRIC HEATING UNITS hold "ironer" roll surface at 450 F

"Beryllium Bazooka" To Dispose of F Lamps



COMPONENT PARTS of beryllium bazooka for breaking a fluorescent lamp are: (A) barrel; (B) cap with catch; (C) pistol grip with spring; (D) toggle mechanism; (E) tension rod; (F) sharpened plunger; (G) adjustable anvil



COLLECTOR RINGS carry energy to heaters inside roll

A DEVICE for safe disposal of fluorescent lighting tubes has been developed by the Division of Industrial Hygiene, New York State Labor Department, Albany, N. Y. The device, termed a "beryllium bazooka" by its designers, Arthur C. Stern, Chief of the Division's Engineering Unit, and Samuel C. Wilson, Senior Industrial Hygiene Engineer, represents the latest phase of the Department's long investigation of the control of hazards created by the presence of beryllium in fluorescent tubes, neon signs and cathode ray tubes.

The "beryllium bazooka" consists of a metal barrel into which the fluorescent tube is inserted. The upper end is closed by a cap and the lower end inserted in a bucket or large can of water. A pistol grip on the side, when squeezed, forces a sharpened plunger against the wall of the tube, splintering it. The bursting effect is contained within the barrel, and the water prevents dissemination of any dust. When the grip is released, the shattered pieces of tube drop into the vessel of water. The device is adjustable for tubes of varying sizes. Labor Department Engineers suggest that if a wire mesh basket is placed in the bottom of the water vessel, the glass fragments can be lifted out readily for disposal, and the water poured down a drain.

Here's on-the-job proof of instrument performance!

largest hydroelectric development in the world . . . employs WESTINGHOUSE INSTRUMENTS

The *Coordinated Design and Styling* of Westinghouse instruments contribute greatly to the space-saving arrangement and excellent appearance of this installation.

For such complex and exacting instrument applications, *reliability* is a "must". Every part of Westinghouse instruments is completely designed and manufactured by Westinghouse to insure proper relation with all other parts. This undivided responsibility and attention to all details assures you of unfailing performance.

What are YOUR electrical measuring problems?

Would they include—reliable performance . . . styling . . . size . . . readability . . . or different types of service . . . portable . . . switchboard . . . panel . . . recording?

The vast lines of Westinghouse electrical measuring instruments provide you with the answers to all of these problems. Every Westinghouse instrument is backed up by more than 60 years of skill, "know-how", and experience in every field of industry.

Westinghouse Instruments Also Provide You With

- Dials that stay white under all conditions.
- Magnets that stay permanent.
- Pivots with high shock capacity and low friction.
- Springs that remain constant for life.
- Quick delivery of more different ratings and types.
- Complete Nationwide Service.

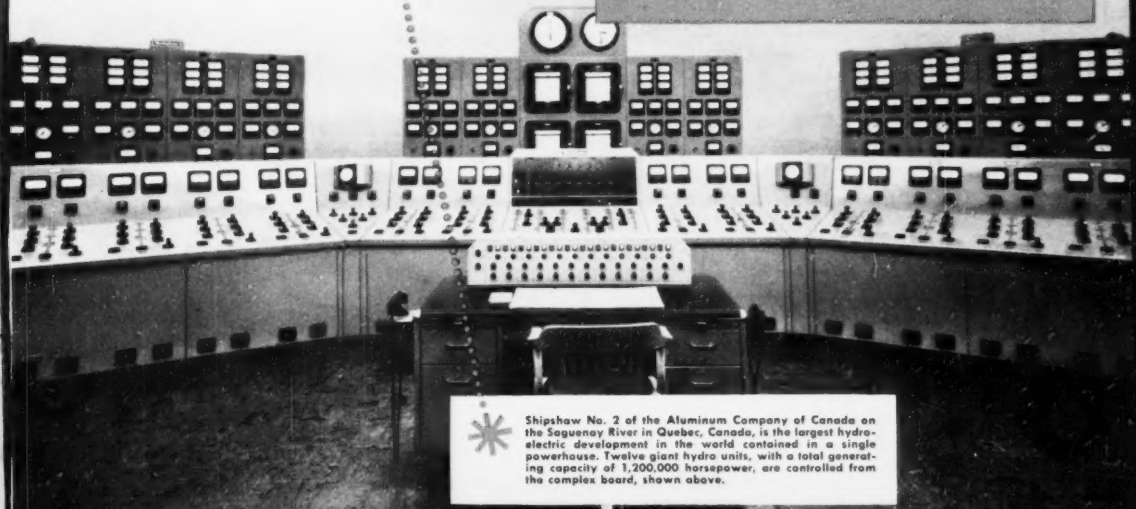
J-40363

Westinghouse instrument specialists are available in the field for consultation on your instrument problems. Call your nearest Westinghouse office, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

Send for booklet B-2209-A, Communication Instrument Booklet B-3283, or Switchboard Instrument Booklet B-3363.

YOU CAN BE SURE... IF IT'S Westinghouse

Electrical Measuring Instruments for ANY Job



Shipshaw No. 2 of the Aluminum Company of Canada on the Saguenay River in Quebec, Canada, is the largest hydroelectric development in the world contained in a single powerhouse. Twelve giant hydro units, with a total generating capacity of 1,200,000 horsepower, are controlled from the complex board, shown above.

NEW EQUIPMENT

Single-Phase Capacitors

AVAILABLE in 15 and 25-kvar sizes, single-phase Askarel-filled capacitors are announced by Moloney Electric Co, St. Louis 20, Mo. Voltage ratings range from 2.4 through 13.8 kv.

Capacitors are housed in hermetically-sealed, heavy gauge welded steel cases and are reported as meeting all EEI-NEMA standards.

•

Selenium Rectifiers

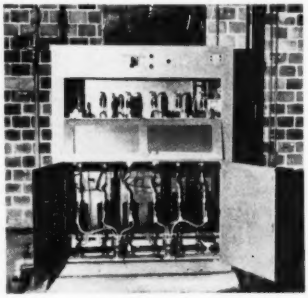
To supply direct current for production or laboratory testing of d-c motors, solenoids or ignition systems, selenium rectifier units are produced by Mellaphone Electronic Rectifier Co, Rochester 2, N. Y. Three-phase, full-wave rectification provides a smooth, output-voltage wave shape without filters according to the manufacturer.

Automatic voltage control is said to hold the d-c voltage at the preset value, regardless of line voltage fluctuations or variations in the load. Illustrated is a unit which operates from 220 v a-c and delivers 100 amp. Output voltage can be set and maintained within 0.05 v in the range from 0 to 8 v d-c.

•

Speed Control Unit

Increased production, closer quality control and lengthened machine life are possible with an electronic, automatic speed control unit for machinery prime movers manufactured by Industrial Associates, 8845 W. Olympic Blvd, Beverly Hills, Calif.



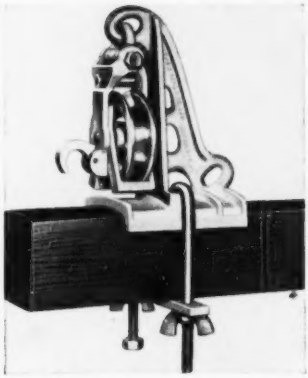
Known as the Varitronic drive, this unit is a simplified system which utilizes the flexible performance characteristics of d-c motors, but operates from an a-c supply. It embraces either constant torque or constant horsepower. Control can be held within limits as close as 2% of basic speed, according to the company.

Use of the drive permits flexible remote push button control, dynamic braking, automatic reversing, inching, jogging, controlled acceleration and deceleration and control of input torque or horsepower.

•

Wire Stringing Pulley

Designed not only for wire stringing operations but for conductor prestressing and as a transformer gin as well, a lightweight universal wire stringing pulley of cast aluminum alloy is announced by Pieper-Lillard, Inc., St. Louis 1, Mo.



Detachable pulley assembly has side opening latch to insure easy insertion and removal of conductor. Bracket has base plate designed to mount on any crossarm and an extra hanging "eye" at the rear for double block pole mounting operations.

•

Portable Instruments

Featuring improved scale visibility and more efficient shielding, a series of a-c and d-c portable instruments is offered by Weston Electrical Instrument Corp, 617 Frelinghuysen Ave, Newark 5, N. J.

Designated the Model 901 series,

HUBBARD round end crossarm braces are NEW

1. **The only flat steel brace made exclusively with rounded ends.**
2. **No jagged or sharp corners to catch on clothing or equipment.**
3. **Made in all communication and power standards.**
4. **Lengths from 20 to 32-inches. Made from 1-7/32 by 7/32 inch or 1-1/4 by 1/4 inch steel.**
5. **Protective coating—Hubbard Double Dip Hot Galvanizing.**

Hubbard and Company has pioneered an entirely New trend in flat steel crossarm brace production. Under the New procedure, all braces now have rounded ends. This New trend has achieved a three-fold purpose; easier handling, greater safety and neater appearance. Accidents involving lost time are reduced in number by the elimination of sharp corners. Hubbard Round End Crossarm Braces are preferred by the Linemen—the men who "Hang the Load on Hubbard Hardware."

HUBBARD AND COMPANY

PITTSBURGH
CHICAGO

OAKLAND,
CALIF.

HANG THE LOAD ON HUBBARD HARDWARE

Silicone News

DC SILICONES

Silicone Insulation Gives 200 Times Class "A" Life in Tread Cutter Motors

Lake Shore Tire and Rubber Specifies Silicone Insulation for Critical Motors

Case histories from all fields of industry prove that Dow Corning Silicone (Class "H") Insulation pays remarkable dividends. The initial cost of rewinding a motor with Silicone Insulation is about twice the cost of a conventional rewind job but Silicone Insulation lasts 10 to 200 times as long. The increase in production that comes of continuous operation is a bonus paid by Dow Corning Silicones.

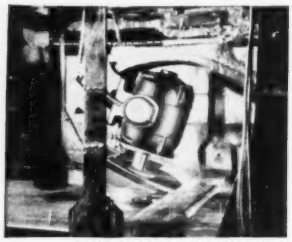


PHOTO COURTESY LAKE SHORE TIRE AND RUBBER CO.

Rapidly reversing tread cutter motors rewound with Dow Corning Silicone Insulation have more than 200 times the life of Class "A" motors.

At Lake Shore Tire and Rubber Company of Des Moines, Iowa, open type 2 h.p. motors are used to drive disc cutters that scarf cut tread stock into lengths. These motors reverse 12 times per minute and operate in a mist of the water used to lubricate the cutters. Life of Class "A" motors in this service ranged from 4 days to a few weeks. Production suffered and maintenance costs were abnormally high.

Lake Shore's electrical maintenance engineers had these motors rewound with Silicone Insulation over 2 years ago. They have already given as much as 200 times the service life of Class "A" motors. This proof of Silicone economy convinced Lake Shore engineers that DC Silicone insulated motors should be used in other essential production equipment such as McNeil Vulcanizers and Banner Bias Cutters.

Here, as in any production plant, Dow Corning Silicone Electrical Insulation greatly increases the life and reliability of hard working motors and motors on which production schedules depend. For more case histories write for pamphlet G7AB4.

DOW CORNING CORPORATION

MIDLAND, MICHIGAN

Atlanta • Chicago • Cleveland • Dallas New York • Los Angeles

In Canada: Fiberglas Canada, Ltd., Toronto

In England: Albright and Wilson, Ltd., London

Dow Corning

FIRST IN SILICONES

these instruments have non-breakable windows that reduce shadows and provide an unobstructed view of the large 5 ½-in. scales; are equipped with hand-calibrated mirror scales and knife-edge pointers.

Model 901 instruments are available as d-c voltmeters, volt-ammeters, ammeters, milliammeters and microammeters; Model 904 of the series is available in a-c voltmeters ammeters and milliammeters.

•

Industrial Fixture

An industrial fluorescent fixture, the Economy Model EF-240, is produced by Sylvania Electric Products Inc. Salem, Mass., which utilizes two 40-w lamps and Glostat starters and is built completely wired, ready for installation.

Features of the lamp include a one-piece chassis, standard knockouts for easy conduit entrance, lanced-out hanging ears for chain mounting, a cut-off adequate for many industrial applications, high power factor ballasts—85% or better, and UL approval. The fixture is claimed to have a reflector efficiency superior to any comparably priced fixture on the market.

•

Smoke Density Indicator

Designed to indicate industrial smoke density levels, a smoke density indicator, announced by General Electric Co's Control Divisions, Schenectady 5, N. Y., can also be used to control over-the-fire heated air to the firebox.

The equipment consists of a light source, a phototube holder and housing

(illustrated) containing the required control and incorporating an indicator calibrated in Ringlemann units. If desired, a recorder of the continuous strip chart or circular "step" type can be furnished. Bulletin GEA-5254 contains additional information on this recently developed indicator.

•

All-Purpose Truck Body

FEATURING added floor space gained by placing the utility compartments out over the wheels, an all steel truck body is manufactured by Morrison Steel Products, Inc. Buffalo, N. Y., to fit standard ½, ¾ and 1-ton chassis.

Construction of the Morrison Carry-All permits installation of such equip-

ment as derricks, winches, pipe vises and support jacks. Accessories which include overhead ladder racks, canvas tops and sliding metal roofs, sectional shelves and side boxes may be specified. Safety tread floor and weatherproof compartments are provided.

•

Dry Battery Pack

HAVING a reported current rating above ½ to 3 amp per hr for continuous duty, a multiple cell, 7½-v dry battery pack has been developed by Carpenter Mfg Co, Boston-45-Somerville, Mass.

The battery weighs 9 lb and measures 3⅞ x 7 x 6½ in., including screw terminals. It is suitable for hand searchlights and other devices which require a 7½-v supply.

•

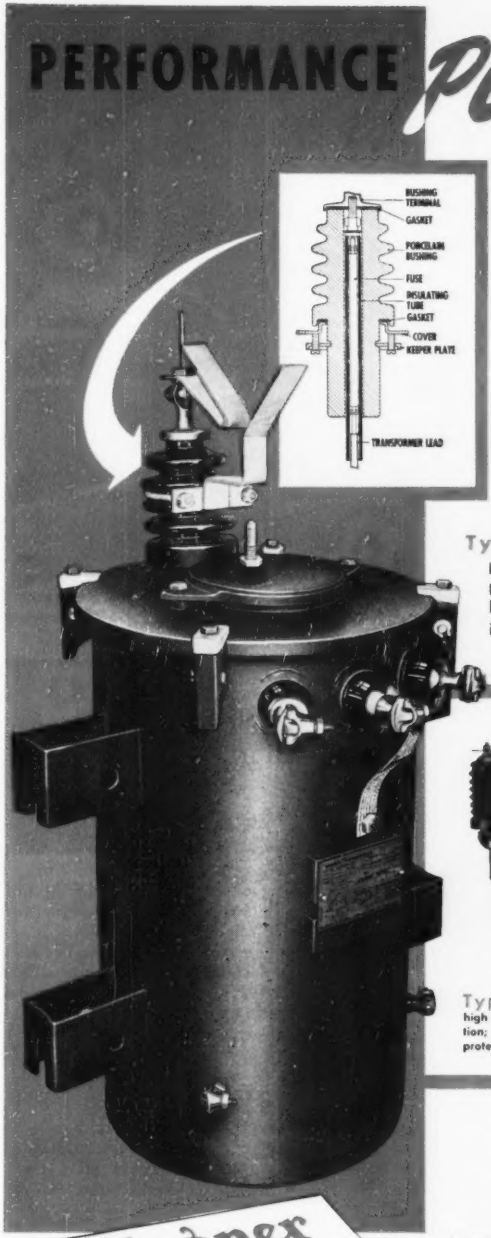
Charger Capacity Doubler

A device which can be attached to General Electric Co rectifier type truck battery chargers to double their capacity, the sequence charge control, has been developed by the company's Lighting and Rectifier Divisions.

By means of the device (lower right), two fully discharged batteries may be charged in 13 hr from a single rectifier, utilizing the automatic two-rate method

PERFORMANCE *PLUS* PROTECTION

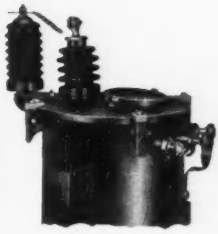
When you install pole-type transformers on your rural line, choose Wagner Transformers and be sure of dependable, efficient service. They have established enviable service records in the field, and uphold the Wagner reputation for reliable transformer performance.



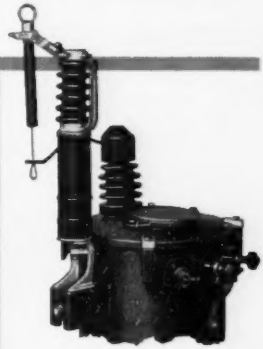
Wagner makes a complete line of Rural Transformers

The Wagner line offers a selection of types with protective features to meet your specific needs. In addition to the types shown, a conventional type HEF is also available.

Type HEF-5: Double "bird-proof" gap provides surge protection; internal fuse, shown in diagram above, forms a protective link between the transformer and the high voltage line to prevent "line lockout" if the transformer is damaged in operation.



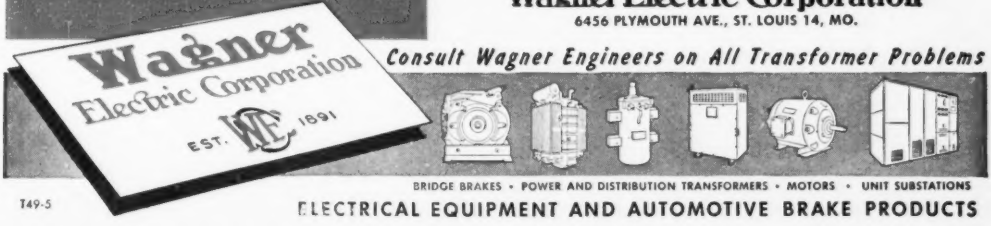
Type HEF-3: De-ion Gap on high voltage side provides surge protection; secondary circuit-breaker provides protection against overloads.



Type HEF-7: Expulsion-type lightning arrester provides surge protection; primary overload limiter link protects against overloads.

For further information on Wagner Rural-Line Transformers, write for Bulletin TU-1C.

Wagner Electric Corporation
6456 PLYMOUTH AVE., ST. LOUIS 14, MO.



Consult Wagner Engineers on All Transformer Problems

BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

ELECTRICAL EQUIPMENT AND AUTOMOTIVE BRAKE PRODUCTS

T49-5

"This Phenolite Part is the solution to that insulation problem*"

*Required:
A material with very high insulation resistance under all atmospheric conditions—with good mechanical strength and ready machinability. Phenolite, laminated plastic, with all these qualities, plus—was the perfect answer.

In your development of efficient, economical products, it pays to investigate

PHENOLITE Laminated PLASTIC

About one-half the weight of aluminum, possesses an unusual combination of properties—a good electrical insulator, great mechanical strength, high resistance to moisture; ready machinability. Sheets, Rods, Tubes, Special Shapes.

NATIONAL VULCANIZED FIBRE

A tough, horn-like material with high dielectric and mechanical strength. Excellent machinability and forming qualities, great resistance to wear and abrasion, long life, light weight. Sheets, Rods, Tubes, Special Shapes.

PEERLESS INSULATION

The *first* fish paper developed for electrical insulation. Strong, smooth, flexible, with excellent forming qualities. High dielectric strength. Sheets, Rolls, Coils.

To help you solve your specific development problem—available without obligation—National Research and Engineering Service.

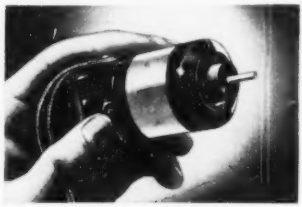
NATIONAL VULCANIZED FIBRE CO.
WILMINGTON DELAWARE
Offices in Principal Cities
Since 1873

of charging employed in standard GE rectifier chargers. Basic characteristics of the original charger are restored by throwing a switch.

•

Servo Motor

ENERGIZED from the plate circuits of a subminiature vacuum tube amplifier, a d-c subminiature, 1/500-hp servo motor is manufactured by Holtzer-Cabot, Inc. 125 Amory St. Boston 19, Mass. Designated the RBDS-0810, it measures 15/8 in. in diam and 2 9/16 in. between



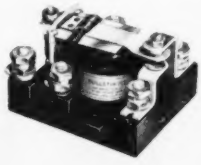
hubs and operates on a field current of 6 ma, with a stalled armature current of 0.8 amp.

The motor has two independent high impedance field windings for reversible operation. Maximum speed is reported to be 14,000 rpm.

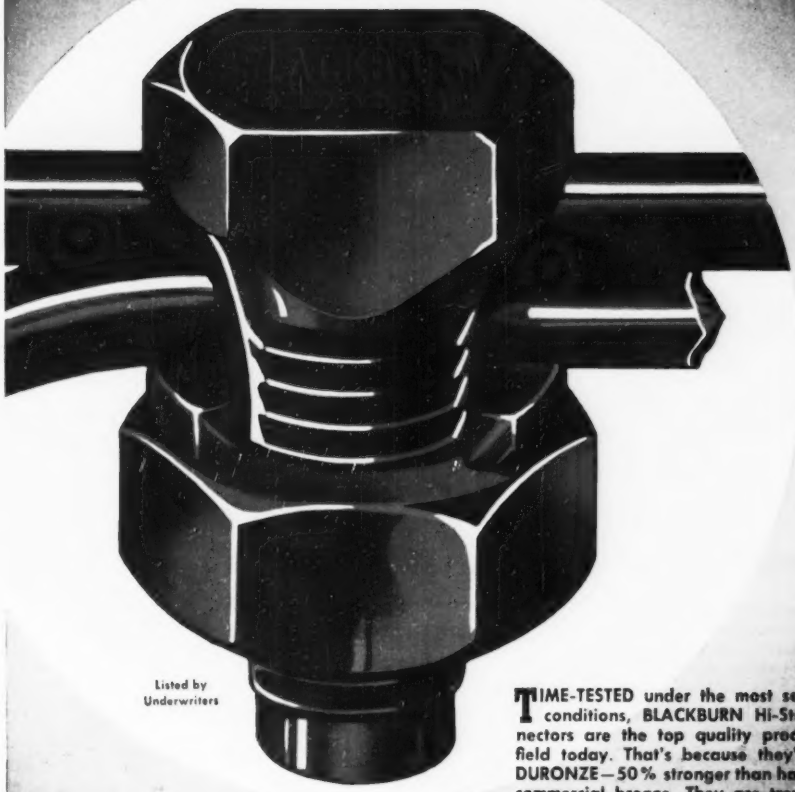
•

Magnetic Relay

FOR remote and automatic control where conditions of vibration and shock are encountered, Bulletin 103 magnetically operated, aircraft power type re-



America's No. 1 Connector!



Listed by Underwriters

TIME-TESTED under the most severe service conditions, BLACKBURN Hi-Strength Connectors are the top quality product in their field today. That's because they're made of DURONZE—50% stronger than hard copper or commercial bronze. They are trouble-free on the line. They produce a more efficient connection. They last longer—will not season crack. They will not twist or distort when tightened up, and can be used over and over again. In short, they are the strongest—most economical—most satisfactory connectors made!

Stop in and inspect our plant when you are in St. Louis

JASPER BLACKBURN PRODUCTS CORP.

FIRST, MADISON & CLINTON STS. • ST. LOUIS 6, MO.

Phone CEntral 3007

BUILDERS OF QUALITY PRODUCTS FOR 45 YEARS

BLACKBURN *Hi-Strength* CONNECTORS

OVER 100 CONVENIENTLY LOCATED JOBBERS

Beats "friction tape" 8 ways!

Bauer & Black

Electrical Tape #163

...gives you 8 "extras" at no extra cost!

Wherever you now use "friction tape," you'll want to try No. 163, the new Bauer & Black electrical tape. It will make your splices less bulky, more moisture-resistant, cleaner, and dielectrically stronger! No. 163 beats ordinary ASTM friction tape eight ways, and gives you *more for your money!*

A thin, cloth-backed, black tape, No. 163 is a pleasure to work with. It unwinds easily, sticks quickly and firmly and is non-fraying. The cloth *backing* is *not* sticky, and so does not pick up dirt and grime. Thinness plus high dielectric strength means neater, less bulky splices and wraps. Yet, No. 163 costs you no more than most ASTM friction tape!

Look at these "extras"

- Higher dielectric strength
- Better moisture barrier
- Less bulk—with equal strength
- Sticks quicker (higher "tack")
- Cleaner—doesn't collect grime
- Unwinds easier
- Doesn't fray
- Sticks firmly to any clean surface

SPECIAL INTRODUCTORY PACKAGE: Contains five ¾-in. x 90-ft. rolls. See your distributor, or write Dept. 5-5, Bauer & Black.

A product of

BAUER & BLACK

Division of The Kendall Company, 2500 S. Dearborn St., Chicago 16

Industrial Adhesive Tape

PRESSURE SENSITIVE

Production Short Cuts to Reduce Costs • Research to Speed and Improve Methods

lays have been developed by Ward Leonard Electric Co. 31 S. St. Mount Vernon, N. Y.

Mounted on a phenolic base, the contact gap, tail spring and normally closed contacts are adjustable. D-c relays are reported to withstand acceleration tests above 10g and vibrations of 60 cycles and 1/32-in. amplitude. Continuous duty coils are available for operation up to 115 v d-c or 230 v 60 cycles.

•

Electronic Rectifier

APPLICABLE as an auxiliary power source where precision filtering and ripple voltage heat losses are not critical, the VSX full-wave rectifier is produced by Reliance Electric & Engineering Co. 1076 Ivanhoe Rd. Cleveland 10, Ohio.

The unit may be housed in a steel cabinet or mounted on an open panel. Available in ratings of 300, 500, 750 and 1,250 w, the rectifier produces a 250-v supply from 110, 220/440 or 550-v sources, or any other standard a-c voltage between 110-550 v, 50/60 or 25 cycles. Bulletin K-2125 describes design features of the unit.

•

Louvred Module

A LOUVRED MODULE designed to be trimmed and snipped, with regular sheet metal shears, into any conceivable form and still keep its rigidity and cube alignment has been perfected by General Lighting Co, Inc, 1527 Charlotte St, Bronx 60, N. Y. The manufacturer advises that these modules provide the architect with a product he can form and design and with which he is limited only by his own imagination and originality.

The louvres are manufactured in cubes of 3, 2 and 1½ in. The standard module is made up in 18 x 48-in. sections. Large or smaller sections are available using the same methods of construction. These sections are hung on T-bar frames suspended from adjustable hangers. Custom manufactured work may be fabricated from the architects specifications.

Large Utility Company

Cuts Cable Installation Costs

up to 50%

. . . and gets 10% greater current carrying capacity!

For its recently built new boiler and turbine room, a well-known electric utility company chose to wire the installation with ROCKBESTOS A. V. C. spiral armored multi-conductor power cables.

Experience in its old plant had taught this company that the cost of installing interlocked armored cable is less than one-half that for cable in conduit.

Moreover, current carrying capacity of 3-conductor spiral armored cable is safely indicated to be 10% greater than three single conductors in conduit with normal occupancy.

Material, time and labor savings like these can be yours.

And they can be more dependably yours when you specify ROCKBESTOS A. V. C. — the original cable with the *permanent* insulation of impregnated felted asbestos.

Write.

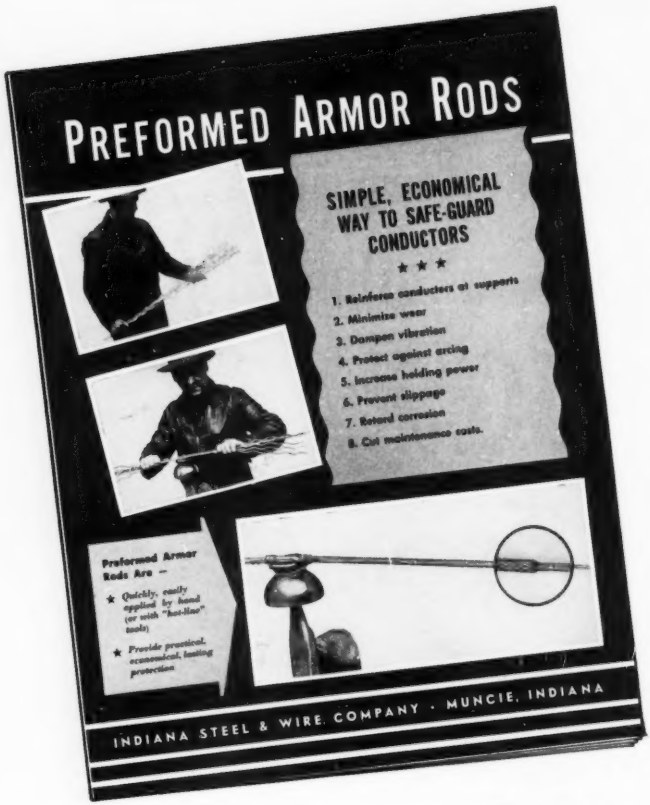
ROCKBESTOS PRODUCTS CORPORATION
NEW HAVEN 4, CONN.

New York	Cleveland	Detroit	Chicago
Pittsburgh	St. Louis	Los Angeles	Oakland, Calif.

WIRES and CABLES by

ROCKBESTOS

. . . . . dare to be better


PREFORMED ARMOR RODS
SIMPLE, ECONOMICAL WAY TO SAFE-GUARD CONDUCTORS
★ ★ ★
1. Reinforce conductors at supports
2. Minimize wear
3. Dampen vibration
4. Protect against arcing
5. Increase holding power
6. Prevent slippage
7. Retard corrosion
8. Cut maintenance costs.
Preformed Armor Rods Are —
★ Quickly, easily applied by hand (or with "hot-line" tools)
★ Provide practical, economical, lasting protection
INDIANA STEEL & WIRE COMPANY · MUNCIE, INDIANA

Write for This Booklet!

PREFORMED ARMOR RODS provide a simple, practical, economical method of reinforcing and protecting overhead conductors at the point of and in the region of the supports. They minimize wear and chafing, tend to absorb and dissipate vibration, protect the conductor against arching and flash-overs, afford increased holding power against slippage, lessen the possibilities of corrosion, reduce overall maintenance expense.

Easily applied by hand or with "hot line" tools. Available in galvanized or stainless steel, aluminum, copper or bronze.

Distributed by GraybaR

Please ask for Booklet PR-101

INDIANA STEEL & WIRE COMPANY · MUNCIE, INDIANA

MORE NEW PRODUCTS
about which you should know

Cool-Amp Co, 8603 S.W. 17th Ave, Portland, Ore., has developed a **silver-plating powder** for plating high-amperage connections on the job, using only a steel wire brush or abrasive cloth. . . . Davey Compressor Co, Kent, Ohio, announces the 1949 model, 160 cfm Auto-Air **compressor** (truck-mounted), driven directly from truck engine through a power take-off. . . . Brewer-Titchener Corp, Cortland, N. Y., manufactures five and ten-ton, drop-forged safety **hoist hooks** which feature automatic mousing action with tie-lip lock to hold point of hook and prevent losing sling.

Thomas Associates, 4607 Alger St, Los Angeles 26, Calif., offer free draftsman's **tracing sheets** of clamps in $\frac{1}{4}$ to 1-in. sizes, each size shown rotated through 90 deg in 15-deg increments. . . . The Trumbull Electric Mfg Co, Plainville, Conn., is producing the LTG Flex-A-Power **trolley busway** in two, three or four-pole construction, which provides outlets for fluorescent fixtures and small power tools.

Radio City Products Co, Inc, 152 W. 25th St, New York 1, N. Y., has the Model 447A **multitester**, with magnesium panel and new battery arrangement, for measuring a-c and d-c volts, d-c milliamp and amp, and up to 10 megohms with external battery. . . . Kelite Products, Inc, Box 2917, Terminal Annex, Los Angeles 54, Calif., has introduced Formula 504 **cleaner** for removing paint, sludge and light carbon from bright-surfaced metals.

General Electric Co, Fractional Horsepower Motor Divisions, Schenectady 5, N. Y., has a line of unit bearing, shaded pole **f-hp motors**, Type KSP71, in three ratings for 115 or 230 v, to drive portable equipment in horizontal or vertical shaft-up operating position. . . . General Scientific Equipment Co, 2700 W. Huntingdon St, Philadelphia 32, Pa., manufactures the No. 700-B **refueling pump**, with nylon cord and neoprene-coated diaphram, for handling gasoline and motor oil.

Electro-Therm, Inc, Silver Spring, Md., announces electric immersion **heating units** for use in processes where sulphuric acid and other highly corrosive solutions are present; rated from 200 to 5,000 w at from 115 to 550 v. . . . All-State Welding Alloys Co, Inc, 273 Ferris Ave, White Plains, N. Y., offers a compact **welding kit** containing low-temperature alloys and fluxes for any gas welding job. . . . Wilson Car-

bon Co, Inc, 60 E. 42nd St, New York 17, N. Y., manufactures a **depth-hardening powder** for low and high speed steels which neccessitates only heating of steel, application of powder, reheating and quick quench.

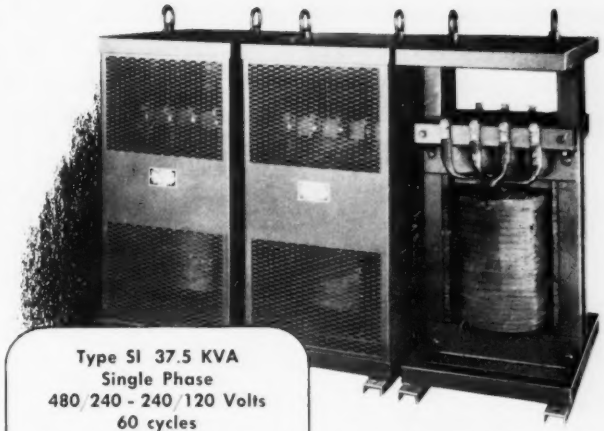
Keystone Mfg. Co, Center Line, Mich., has designed a 90-deg **elbow** for wireways in two sizes, 4x4 in. and 6x6 in. . . . The Nolan Corp, 1333 E. Dominick St, Rome, N. Y., has announced a metal **melting furnace,** the Metal Remelter, with provision for electric, gas or oil heating, for babbitt, solder, wax and insulating compounds in capacities of 650 and 2,000 lb. . . . Tal Bender, Inc, Milwaukee, Wis., has developed a thin-wall-tubing **bender** to handle all sizes from 1 to 2-in. diameter.

Sierra Electronic Corp, 1209 Old County Rd, Belmont, Calif., manufactures a 3 to 40-kc. frequency-selective **db meter,** Model 103 Voltmeter, for carrier-telephone and carrier-telegraph systems. . . . Industrial Products Co, 2820 N. Fourth St, Philadelphia 33, Pa., offers Clearview **first aid cabinets,** unit No. 36 for shops employing 10 to 50 people, and unit No. 66 for plants having 50 to 100 or more employees. . . . Baldor Electric Co, 4351-67 Duncan Ave, St. Louis 10, Mo., is producing the 60 series **grinder buffer** with 6-in. grinding wheel at one end and 6-in. wire brush at other end, powered by ¼-hp. 3,400-rpm motor; Bulletin No. 321-D contains further information on Baldor products.

Weldit, Inc, 990 Oakman Blvd, Detroit 6, Mich., has a series of **gas torches** designed to use atmospheric air and either propane or acetylene for paint removal or fine soldering and heating jobs. . . . Thyco Electrical Products Inc, Los Angeles, Calif., manufactures plastic **eletrical plugs** with finger grips for easy removal from wall receptacles. . . . Fox Valley Instruments Co, Ingleside, Ill., has developed a small high-resistance **line voltage tester,** the Polyvoltester, for identifying 110 and 220-v lines and polarity and testing fuses, shorts and grounds.

Amplifier Corp of America, 398-25 Broadway, New York 13, N. Y., produces the Magnerasor magnetic tape **erasure unit** which renews plastic or paper-base recording tapes for additional recordings by simply being moved around the tape reel periphery; operates from 100/130-v, 25/60-cycle source. . . . Lincoln Precision Machining Co, North Grafton, Mass., has announced the Lug-All, aluminum-alloy, **portable hoist** capable of lifting up to 1½ ton, furnished with 15-ft. 133-strand cable.

Carma Mfg Co, 2401 E. 103rd St, Los Angeles 2, Calif., produces small, lightweight, solenoid-operated **valves** for air or fluids, for operation between −65 F and +200 F and pressures up to 12 psi.



Type SI 37.5 KVA
Single Phase
480/240 - 240/120 Volts
60 cycles

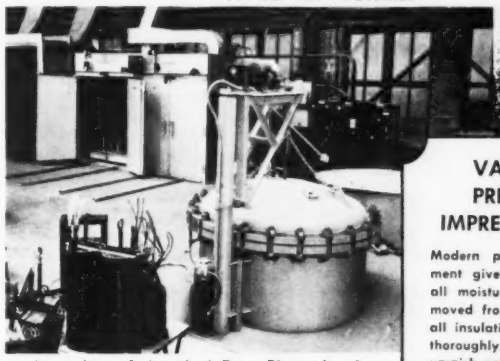
Enclosure removed to show terminal boards with solderless connectors for easy installation.

Hevi Duty

TRANSFORMERS

for lighting and small power loads

Get greater latitude in planning lighting and power circuits with rugged Hevi Duty Transformers. Sizes from 250 VA to 1000 KVA. Write for details.



A section of the Hevi Duty Plant showing coils that have been impregnated with varnish, impregnating tank, varnish storage tank, control panels and baking ovens.

VACUUM PRESSURE IMPREGNATION

Modern processing equipment gives assurance that all moisture has been removed from coils and that all insulating materials are thoroughly permeated with varnish and bonded together — resulting in better insulating properties and quiet operation.

HEVI DUTY ELECTRIC COMPANY

HEAT TREATING FURNACES HEVI-DUTY ELECTRIC EXCLUSIVELY

DRY TYPE TRANSFORMERS — CONSTANT CURRENT REGULATORS

MILWAUKEE 1, WISCONSIN

NEWS ABOUT PEOPLE

Allen Made Midwestern Editor, Electrical World

Edward Allen, general service engineer for the Electric Power Board of Chattanooga since 1945, and, previous to that association, editor of *Electric Light and Power*, has been appointed Midwestern editor of ELECTRICAL WORLD with headquarters in Chicago, effective May 15. Mr Allen is succeeding Julius C. Meier, who has resigned to join W. N. Matthews Corp, St. Louis, Mo., as application engineer.

EDWARD ALLEN

Mr Allen brings to his new editorial position a broad background of engineering operation in the electric utility field, in addition to several years' experience in editorial work. Following graduation from Louisiana State University in 1925, he spent one year with the Chicago Central Station Institute, the training branch of all Insull companies. His assignments included the Commonwealth Edison shops, the Chicago Heights district of Public Service Co of Northern Illinois, the Crawford Avenue generating station of Commonwealth Edison, and the Lacon district of Public Service.

Upon the completion of the Institute course, he was assigned to the Lacon district, where he engaged in all types of field engineering work—design and operation. In 1927, Mr Allen was transferred to the Maywood district for miscellaneous distribution design work, and, the following year, was appointed senior engineer of the district. In 1930 he was called to the general office in Chicago to undertake transmission design, system planning, distribution design, and standards and specifications work. From 1931-37 he engaged in field engineering, including transmission and distribution, in the Harvey district (the old Chicago Heights district) and in Joliet.

JULIUS C. MEIER

It was in 1937 that Mr Allen joined the staff of *Electric Light and Power* as engineering editor, subsequently becoming editor. In these editorial capacities, he obtained extensive writing experience, planned the magazine's editorial program, and made contacts for editorial material. In 1945 Mr Allen went to Chattanooga, where his work has been in personnel, safety, customer service and supervision of the editing of the employee publication.

Mr Meier has spent his whole industrial life in the electrical field. He joined the editorial staff of ELECTRICAL WORLD in New York in 1944 and has been midwestern editor since 1947. Following graduation from Clarkson College in 1930, and completion of the Westinghouse Electric Corp's student test course one year later, he became affiliated with the Western Massachusetts Electric Co, where he obtained experience in the service, sales, and operations departments. During his association with ELECTRICAL WORLD Mr Meier has specialized in apparatus design changes and developments.

•

R. C. Walter has resigned as manager of city utilities at Llano, Tex., to enter private business.

Montana Power Appoints Martin Chief Engineer

A. B. Martin has been named chief engineer of the Montana Power Co, Butte, succeeding H. H. Cochrane, recently retired after fifty years' service. A. C. Pratt, formerly assistant chief engineer, retired at the same time as Mr Cochrane. Both have been retained by the company as full-time consultants.

F. W. Bird, president, also announced the retirement of Vice-President and General Superintendent M. E. Buck, who has been succeeded by Carl Jordan, now assistant general superintendent.

L. S. Stadler, engineer in the gas department, has assumed Mr Martin's former duties as superintendent of that department. E. A. Hamilton is now superintendent of generation; C. H. Kirk, superintendent of transmission and distribution; and H. K. Dickinson, electrical engineer.

A. B. MARTIN

•

Vincent P. McDevitt has been elected vice-president in charge of legal matters of the Philadelphia Electric Co. He has been general counsel of the company since 1947. After being admitted to the Bar in 1928, he engaged in general legal practice until he was appointed assistant district attorney of Philadelphia in 1935. For ten years he was prominently identified with the work of that office. In 1945 he was named chief counsel of the Pennsylvania Utilities Commission and served in that capacity until 1946, when he re-

Close to You Anywhere, Ryerson Stocks—Ryerson Service

No matter where you are, or where you want steel delivered, there's a Ryerson plant, with diversified Ryerson steel stocks, within quick shipping distance. A network of thirteen big plants, plus twelve district sales offices, makes Ryerson steel service the most comprehensive and convenient in the nation.

Each big Ryerson plant is set up to operate independently with large stocks and high-speed cutting and handling facilities, plus its own complete staff of carbon, alloy and stainless steel specialists. Yet each Ryerson plant and office offers the advantages of a unified organization with a hundred and six years of practical steel experience.

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PAGE
Stainless Steel
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for GROUND
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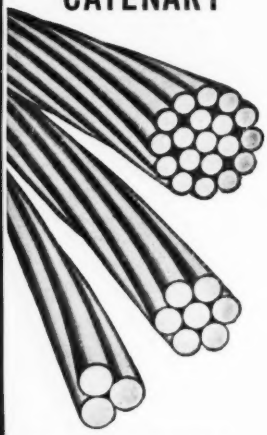

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PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

signed to devote full time to his private practice in Philadelphia. Mr McDevitt is a member of the council of the public utilities section of the American Bar Association.

J. R. Lester, manager of the industrial development division of the Alabama Power Co, Birmingham, since 1943, has been made manager of the company's rural and towns division. Mr Lester assumed the duties formerly performed by E. C. Easter, recently made sales manager. **H. Neely Henry,** who has been assistant manager of the industrial development division, becomes its manager. Widely known in Alabama and elsewhere for their efforts in the industrial development field, both Mr Lester and Mr Henry are long-time employees of Alabama Power. Starting in 1919, Mr Lester has served as district manager at Talladega, division sales supervisor, and merchandise sales director. Mr Henry has been associated with the company's industrial development work since 1937 and became assistant manager of the department in 1948.

Harold V. Coes, appointed by Director Paul G. Hoffman to serve as consultant to the industry division of the Economic Cooperation Administration, has left for ECA headquarters in Paris. Mr Coes was formerly vice-president and a director of Ford, Bacon & Davis, Inc, New York, and is a past-president of the ASME.

J. Charles Neville, chief power station operator for the City of Jamestown, N. Y., has retired. Mr Neville had been associated with the development of Jamestown municipal power facilities for the past 46 years. He was made chief operating engineer at the electric light plant in 1922.

ROBERT W. CRANSTON, who was recently appointed general superintendent of substations for West Penn Power Co. He joined West Penn in 1914 at Washington, Pa.

Wheeling Electric Elects Jewell Vice-President

Announcement has been made of the election of Robert R. Jewell as vice-president of the Wheeling (W. Va.) Electric Co, to succeed the late C. Hal Brues.

Mr Jewell started his career in the American Gas & Electric System, of which Wheeling Electric is a unit, in

ROBERT R. JEWELL

1916, when he became a substation operator at Cambridge, Ohio. Five years later he was transferred to Dennison, Ohio, as assistant superintendent of the company's operations in that area. In 1920 he was promoted to district superintendent, at Coshocton, Ohio, and later at New Philadelphia, Ohio. He became division manager of the Sunnyside division of the Ohio Power Co in 1936, with headquarters in Bellaire.

It was in 1947 that Mr Jewell was named assistant general manager of the Wheeling Electric Co, and later that same year he became general manager.

•

H. E. Leilich, formerly mechanical engineer and power plant project manager for the Rust Engineering Co, has joined the staff of the Peter F. Loftus Corp, engineering consultants, Pittsburgh, Pa.

OBITUARY

Charles J. Staples, general counsel and director emeritus of the Carrier Corp, Syracuse, N. Y., died on Apr 26 at his winter home in Deleon Springs, Fla. He was 75 years old. In 1915 Mr Staples joined Dr Willis H. Carrier and J. Irvine Lyle in the formation of the Carrier Engineering Corp and became a director of the present Carrier Corp when it was formed in 1930. He was made director emeritus last year.

James W. Bayliss, secretary-treasurer of the Niagara Falls Hydro Commission, died on Apr 20 in Niagara Falls, Ont. He was 68 years old. In 1913 Mr

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MATERIALS: G. E. ¼ H.P., 115 V., 1 Phase, motor for outdoor service. Sealed ball bearings. Water slinger on shaft. 2 ft. Geoprene leads. 18" steel, 3 blade, Cadmium plated fan. Spot welded guard of ¼" steel rod. Baked enamel finish. Shipping wt. 60 lbs.

ACTION: A long life fan of engineered design, that delivers a high velocity volume. Air Movement 8,513 C.F.M. 6 ft. from blade, with Average Velocity of 537 ft. per minute over 4'6" Diameter Circle. Easily carried by one man. Quick adjustment of fan angle—from 30 degrees below horizontal to vertical. Can be mounted permanently on a pipe structure.

RESULTS: ArmaWind Transformer Cooling Fans have "stood up" for 15 years. One utility company has purchased over 1500. Many satisfied users. Prompt shipment—from our plant to you.

Also, Makers of Man Cooling Fans.

Armature Winding Co.
Charlotte, N. C.

Bayliss was named secretary of the municipal electric light plant in Niagara Falls, which was taken over in 1916 by the Hydro Commission.

C. Neal Barney, vice-president, secretary, and general counsel of the Worthington Pump & Machinery Corp., New York, died on Apr 24 at his home in Scarsdale, N. Y. He was 73 years old. Mr Barney joined the Worthington organization in 1918.

Jack L. Calpin, director of commercial sales, Public Service Co of New Hampshire, died suddenly at his home in Manchester on Apr 15. He was born in Somerville, Mass., and joined the company in 1924. Mr Calpin was long active in the Power Engineers Association of New England and was well known in industrial circles in northern New England.

William H. Woods, superintendent of city street lighting for the Toronto Hydro-Electric system for the past 35 years, died on Apr 16 at his home in Toronto. He was 63 years old. A graduate of the University of Toronto, Mr Woods was known as an expert on lighting in the United States and Canada. He lectured at several Canadian universities. Mr Woods was a member of the Illuminating Engineering Society.

William G. Starkweather, 79, president of the Starkweather Engineering Co, Inc, Newton, Mass., died in that city Apr 23. A native of Milwaukee, Wis., and Cornell graduate in 1892, he founded the engineering firm of Tracy, Starkweather & Tracy, San Francisco, in 1895. Later he was New England representative of the Allis-Chalmers Mfg Co, at Boston. He founded the house bearing his name in 1907 and was widely known in the power plant equipment field in the Northeast section of the country.

William H. O'Neil, 45, manager of the Amherst and Easthampton districts of the Western Massachusetts Electric Co, died at Boston Apr 20. Born in Greenfield, Mass., he was educated at Northeastern University. He joined the then Greenfield Electric Light Co in 1924 and also worked later with the affiliated Turners Falls Power Co. Mr O'Neil was active in meter department and service department duties in his early career, as well as in power sales. In 1933 he was made manager at Easthampton for the successor W. M. E. company and in 1944 received the above named dual responsibilities.

Edward Caton, 58, an electrical engineer in the applications division of the Boston Edison Co, died at Foxboro, Mass., on Apr 23.

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MANUFACTURERS and MARKETS

A STEAM IRONING attachment made by General Mills, Inc, Minneapolis, won the fourth Annual Home Safety Award sponsored by Lewis & Conger, housewares store in New York City. Arthur D. Hyde (right), president of General Mills appliance division, received the bronze plaque from Richard V. Lewis, president of Lewis & Conger, at an award dinner held recently at the Waldorf-Astoria. In the new attachment, steam is formed on the "flash-boiler" principle by water dripping into the steam chamber a little at a time, instead of boiling a quantity of water to produce steam. This is reported to eliminate the possibility of explosion or backup of pressure inside the water tank. Heat for the creation of steam in the appliance, which slips on the Tru-Heat electric iron like a shoe, is furnished by convection from the iron sole plate

Business Seen Holding at High Levels, Price Says

In a recent speech at the recent annual stockholders' meeting, held for the first time in an improvised auditorium in the production aisle in East Pittsburgh, Gwilym A. Price, president of the Westinghouse Electric Corp, stated that in spite of a decline in general business activity this year, there were indications that the total volume of the nation's business for 1949 might not be too far below the peace-time record of 1948.

He further stated that although the demand for capital goods—heavy machinery and equipment—has tapered off, "there are reasons to expect the market for capital goods to hold this year at a physical volume about double the average for the years 1935 through 1939, while production this year should be at least double the 1935-39 average. Even this lower level of operations provides a solid base for continued prosperity, assuming only that it is not destroyed by Government policies thwarting private business and private investment."

"The best estimates of our manufacturing division managers, our business projection committee, and our market staff indicate that orders from our customers in 1949 will be very substantial and may even approach our 1948 total. In making this estimate, there is included an increased proportion of large military orders."

Disclosing the results of Westinghouse operations in 1949, Mr Price reported that new orders booked by the company in the first three months of this year totaled $254,054,157 compared with $271,710,860 in the first three months of 1948. Net sales billed amounted to $226,658,722, compared with $236,071,263.

Reporting that the company's expansion and rearrangement program undertaken after the war was "essentially completed," Mr Price disclosed that approximately $72,000,000 was spent for such purposes during the last two years alone and that about two-thirds of that amount came from the company's earnings left after paying dividends. . . ."

•

Reynolds Cuts Cable Prices on Orders After Jan. 1

A substantial slash in the price of aluminum cable for rural electrification has been announced by Reynolds Metals Co, Louisville, Ky. The reduced prices will be effective on all orders accepted for delivery after Jan 1, 1950, according to David P. Reynolds, vice-president and sales manager of the aluminum division.

The cut in cable prices range from $1.63 up to $4.06 per hundred weight. The new prices also include the one-half cent a pound commission which is paid Wisconsin Electric Cooperative for its services as the distributor. This development will make available this material to vital to extension of rural electrification cheaper and in more abundant quantity than ever before.

An additional advantage which will be enjoyed by REA cooperatives in many sections of the country who place their orders with Wisconsin Electric for delivery after next Jan 1, lies in the fact that there will be a considerable saving on freight. It is estimated that his saving will average more than 1¢ a pound in some of the areas where need for aluminum cable is the greatest.

Price Reduced

Reynolds Metals Co voluntarily reduced the aluminum conductor price under the figures specified in its contract with Wisconsin Electric Cooperative for benefit of the REA cooperatives, when it became apparent that the material could be produced at a lower cost than had been calculated.

In the meantime the first carload of aluminum cable produced under the interim arrangement between Reynolds and WEC was shipped on Apr. 15. The startling announcement of the cut in prices on cable, deliveries of which are to start in 1950, was explained by Mr

Reynolds. He said, "We have produced enough cable on our own equipment to assemble accurate data on production costs. These figures reveal that we can make this price cut next January, at which time we will have completed installation of equipment now on order. . . ."

•

Alcan Surveys Proceed on B.C. Aluminum Plant

The Aluminum Co of Canada is going ahead immediately with engineering surveys to cost $900,000 which may lead to the construction of the world's largest aluminum production plant in central British Columbia.

"We feel sufficiently optimistic with possibilities of your province for an aluminum plant to spend $1,000,000 to find out," said McNeely DuBose, vice-president of the company. The company already has spent $100,000 on initial study of three possible sites in the areas of Chilko Lake, Utsk Lake and Tahtsa Lake, 350 miles north of Vancouver. The surveys are expected to take two years. Surveys will include foundation drilling and transmission line study, the drilling to determine footings required for a dam on Nechako River.

The engineering work will be handled by the International Engineering Co of San Francisco, which, Mr DuBose announced, is incorporating in Canada. The aluminum company also is setting up offices in Vancouver the vice-president stated, but he warned: "There is no foregone conclusion that our plans are going to work out, partly on account of the possible difficulties the engineers may encounter, and also because this is one of the biggest projects anyone has ever tackled anywhere."

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Cutler-Hammer Makes New Office Moves in Ohio

New office moves have been announced by Cutler-Hammer, Inc, Milwaukee, Wis.

The Columbus office, now located at 2700 East Main St, operates as a branch of the Cincinnati district office under the direction of R. D. Yoder. Headed by E. J. Gove, the Youngstown office, at 25 East Boardman St, is a branch of the New York district office.

In a move to facilitate handling increased sales activities in the New Jersey area, the company has opened a Newark branch office located at 155 Washington St. Headed by W. M. Reese, the new office will operate under the supervision of the company's New York district office.

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NEW ELECTRICAL CONSTRUCTION

UTILITIES

Proposed Construction

Ala., Guin—Tombighee Electric Co-operative, Guin, warehouse and office. Gilmore & Rutland, Farm Security Bldg., Montgomery, archts.

Arkansas—Rich Mountain Electric Co-operative, Mena, rural distr. lines extens., Proj. 33, Polk Co. George C. Hengy Co., 1007½ Texas Ave., Shreveport, La., engr.

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Brush-Yuma 69 kilovolt transmission line, Spec. 2555; Flatiron-Greeley 115-kilovolt transmission line, Spec. 2551; Wiggins-Hoyt 115½ kilovolt transmission line, Spec. 2570, all foregoing Colorado-Big Thompson Proj., transmission lines, electric power lines, Morgan, Washington and Yuma Counties, Spec. 2555; Morgan Co., Spec. 2570; Weld Co., Spec. 2551. 115-kilovolt transmission lines, Granby Pumping Plant to Estes Power Plant and Marys Lake Power Plant to Estes Power Plant, between Granby and Estes Park and near Buchanan Pass on Continental Divide, Spec. 2647; 69-kilovolt transmission circuit, incl. cable from Estes Power Plant to west portal of Adams Tunnel and 115 kilovolt transmission line from Estes Power Plant to Marys Lake Power Plant, in and near end of the Alva B. Adams Tunnel between Grand Lake and Estes Park, Spec. 2646, both Colorado-Big Thompson Proj. transformers, circuit breaker, horn-gap switch, disconnecting fuses, disconnecting switches cutouts, lightning arresters, demand meter for Loveland substation Colorado-Big Thompson Proj., Spec. R7-52 (Region 7). L. N. McClellan, ch. engr.

Illinois—Illinois Electric Co-operative, Champaign, 5 mi. 69 KV transmission lines, headquarters facilities, Champaign Co. **$198,000.**

Indiana—Southern Indiana Rural Electric Co-operative, Tell City, 80 mi. rural distr. lines, sys. imprvs., Spencer Co. **$180,000.**

Iowa—Greene Co. Rural Electric Co-operative, Jefferson, rural distr. lines, Greene Co. **$243,000.** Brown Eng. Co., K. P. Bldg., Des Moines, engr.

Ia., Akron—City, City Hall, power plant enlargement, generating equip., switchboard, etc. $75,000. Buell & Winter, 508 Insurance Exchange Bldg., Sioux City, engrs.

Kansas—Ninescah Rural Electric Co-operative, Pratt, 600 mi. rural distr. lines, 4 sub-stations, Pratt and 8 adjacent counties, **$935,000.** Richardson Electrical Eng. Co., Solomon, engr.

Louisiana—Concordia Electric Co-operative, Ferriday, 183.5 mi. rural distr. lines, 16.5 mi. 33 KV transmission lines, sys. imprvs., 11 mi. tie lines, Concordia Co. **$570,000.**

Minnesota—Northern Electric Co-operative Assn., Virginia, sys. imprvs., 393 mi. rural distr. lines, 15 mi. tie lines, 26 mi. transmission lines, headquarters facilities, **$1,185,000.** General Eng. Corp., 2950 Chicago Ave., Minneapolis, consult. engrs.

Minn., Sleepy Eye—Brown Co. Rural Electric Assn., H. A. Rossuth, mgr., warehouse and office, $100,000. Dreher & Ross, Mankato, archts.

Minn., Bemidji—Beltrami Electric Co-operative, Earl Larson, mgr., Bemidji, imprv. rural distr. lines, Beltrami Co. **$360,000.**

Miss., Laurel—Jones County Electric Power Assn., Laurel, warehouse, office, $95,000. Plans deposit $10. Riggs, Weir & Chandler, 224 N. Congress St., Jackson, archt.

Nebraska, Iowa and Illinois—Northwestern Bell Telephone Co., 19 and Douglas Sts., Omaha, Neb., test towers at Omaha, Neb., Chicago, Ill., and approx. 18 towers at various points between the two cities for radio relay sys. Approx. **$500,000.** A. L. Turner, c/o owner, ch. engr.

Nebraska—North Central Nebraska Rural Public Power Dist., Creighton, 363 mi. rural distr. lines, sys. imprvs., completing previously approved constr., Holt Co. **$650,000.**

Nevada—Bureau Reclamation, Dpt. Interior, Boulder City, 2 safety bulkheads, 2 safety doors and 2 safety gates for Hoover Power Plant, Boulder Canyon Proj., Spec. R3-R7.

N. Y., Long Island City—General Electric Appliances, Inc., Boston Ave. and Bond St., Bridgeport, Conn., plans by J. G. Phelan, 211 State St., Bridgeport, Conn., 2 story warehouse, Northern Blvd. near 48 St. **$600,000.**

North Dakota—K. E. M. Electric Co-operative, Linton, 670 mi. rural distr. lines and completing previously approved construction, Emmons Co. **$1,045,000.** Ulteig Eng. Corp., 1114½ Front St., Fargo, consult. engr.

North Dakota—U. S. Eng., Fort Lincoln, Box 300, Bismarck, hydraulic turbines, Garrison Dam, Missouri River. $2,000,000-$4,000,000.

South Dakota — Cherry-Todd Electric Co-operative, Mission, 491 mi. rural distr. lines and 20 mi. transmission line, Todd Co. **$810,000.**

Washington—Public Utility Dist. 1 of Douglas Co., Bridgeport, acquisition and rehabilitation 50 mi. 33 kv transmission line, 82 mi. rural distr. line for 265 mi. rural distr. line, sys. imprvs., incl. 36 mi. 33 kv transmission line and completing previously approved constr., Douglas Co. **$2,318,000.**

Washington—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Bldg., Denver, Colo., one Panel No. 1 for station-service control board SL, one Panel No. 1 for station-service control terminal board and unmounted equip. for mounting on Panels 5 and 7, Grand Coulee Left power plant, Columbia Basin Proj., Spec. 2645.

Low Bidders & Contracts Awarded

Florida—West Florida Electric Co-operative, Graceville, rural distr. line, extens., for expansion rural electric service and facilities. Owner builds. **$400,000.**

Georgia—Lamar Electric Membership Corp., Barnesville, 135.33 mi. rural distr. lines, Lamar, Bibb Crawford, Meriwether, Monroe, Pike, Spaulding and Upson Counties, to Roy Richards Constr. Co., Carrollton. **$149,337.** Bids 4/19.

Montana—Bureau Reclamation, Dpt. Interior, Helena, Canyon Ferry Dam and power plant, 16 mi. northeast Helena, Missouri River Basin Proj., Spec. 2585, to Canyon Constructors (Brown & Root, Inc., P. O. Box 1139, Austin, Tex., Wunderlich Contg. Co., 530 Desnoyer Ave., St. Paul, Minn., Griffin Co., 1060 S. Broadway, Los Angeles, Calif., and J. C. Maguire, 816 W. 5 St., Los Angeles, Calif.), Los Angeles, Calif. **$11,896,425.** Bids 4/6, awarded 4/20.

Ia., Traer—Bd. Municipal Light & Power Plant, Traer, Mar. 29, Sect. 7, plant, Sect. 8, equip., Sect. 9, switchboard, electric equip., from Jens Oleson, 321 W. 18 St., Waterloo. **$128,796.**

Oklahoma—U. S. Eng., Box 61, Tulsa, 2 hydraulic turbines for Tenkiller Dam on Illinois River, Spec. 34-066-49-67, to S. Morgan Smith Co., York, Pa. **$580,911.** Bids 3/1, awarded 4/5.

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Mo., Kansas City — Veterans Admin., Vermont Ave. between H and I Sts. N. W., Wash., 25, D. C., veterans admin. general medical hospital. $8,000,000-$12,000,000.

Tex., Houston — City Housing Auth., George D. Neal, chn., Housing Comm., Sterling Bldg., plans by Wyatt C. Hedrick, engr. and archt., 5201 Fannin St., 5,000 low rent housing units. **$25,000,000.**

Low Bidders & Contracts Awarded

N. Y., New York—Rockefeller Institute for Medical Research, 66 St. and York Ave., hospital and nurses and doctors residence, 1194-1268 York Ave., to Vermilya-Brown, 100 E. 42 St., Zone 17, Approx. **$2,500,000.**

RECENT RATE CHANGES

CENTRAL HUDSON GAS & ELECTRIC CO, Poughkeepsie, N. Y., has been authorized by the New York Public Service Commission to increase electric rates by 3%, to yield the company a net increase of $168,000 upon an annual basis. In its original petition last December, the company proposed rates to produce additional revenue of about $718,000. The increase allowed by the commission is upon an interim basis to Oct. 31, 1949, and the new rates are to become effective upon filing by the company of new tariffs to reflect the increase. An opinion in the matter by Commissioner Spencer B. Eddy sets forth an analysis of the company's property, revenues, and operating costs and concludes that under existing rates the utility is not receiving a fair return on the plant used in providing service to the public. In addition, the company is faced with heavy expenditures for new plant in order to meet the increasing demand for service by its customers.

PENNSYLVANIA POWER & LIGHT CO, Allentown, has filed a new tariff with the state Public Utility Commission aimed at producing additional revenue of $2,240,400 annually by increasing residential rates an average of 5% and commercial rates up to 10% and including "moderate" increases for other classifications. To become effective June 22, subject to PUC procedure and possible hearings, the new rates would be included in the bills issued July 22. David A. Elias, vice-president in charge of the Harrisburg Division, said bills to 96% of the residential consumers in the 27-county area served by the company will not be increased by more than 26¢ a month. Most of the PP&L's 28-year history has seen the rates go "steadily downward," but the company has found it impossible to absorb all the increased costs resulting during and since the war, Mr. Elias said. He said that the cost of coal increased by 115% at the power plants; that the cost of poles climbed by 110%; that copper costs rose 65%, and that "power house equipment, meters, oil, insulators, freight, and wages all have gone up."

MONTANA-DAKOTA UTILITIES CO's request for a general electrical rate increase has been denied by the Montana Railroad Commission. The commission found that the utility system earned 4.11% revenues on plant value during the year ended Sept 30, 1948, that the operating ratio was decreasing, that no increase in electrical rates was justified.

PACIFIC POWER & LIGHT CO's rate charges in Walla Walla, Wash., went under fire when 42 property owners filed a petition with the state Department of Public Service, seeking a review. The petition alleges Walla Walla rates are higher than those charged by the same company in Portland, Ore., and that the company is receiving an excessive return on its investment.

PORTLAND GENERAL ELECTRIC CO has applied for rate increases, which would add $2,170,740 to its annual income. The proposed new tariffs were substituted for a filing made in January in which increased rates were sought in all communities served by the company except Salem, Ore. The new tariffs cover the company's entire operating area.

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Untreated versus Treated
Poles

1925 **1946**

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607 Treated Poles Placed . . . 600 Poles Still Serviceable
(Southern Pine)

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In 1946, after 21 years in line—600 out of 607 Pressure-Creosoted Poles were still serviceable. And of the 7 poles no longer in service, 5 had been removed because of a grade crossing clearance—2 because of an accident. *Not a single one* of the 607 poles had been removed because of deterioration due to treatment or preservative failure—a 100% record for creosote.

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*Proceedings of the American Wood Preservers' Association—1947.

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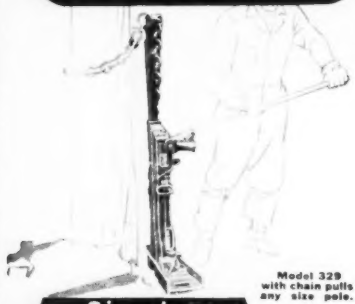

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TECHNICAL LITERATURE

Paper—The fourth edition (Dec 1948) of *ASTM Standards on Paper and Paper Products (with Related Information)* contains 77 specifications and test methods, some covering electrical insulation. Copies of the 286-page book can be procured from American Society for Testing Materials, 1916 Race St, Philadelphia 3, Pa., at $2.50 each.

Boiler Plants—*How to Cut Small Boiler-Plant Costs by Mechanical Coal and Ash Handling* provides data on coal, oil, investment and operating costs on plants with boilers up to 300 hp 100 psi. The 16-page publication is obtainable at 40¢ each from Bituminous Coal Research, Inc, 912 Oliver Building, Pittsburgh 22, Pa.

Copper—A tabulation of mechanical and thermal properties of copper, comparative data on aluminum, magnesium, steel, 18-8 stainless, nickel and beryllium, and a brief discussion of copper alloys are contained in *Tempil Topics*, Vol 4, No. 1, issued by Tempil Corp, 132 West 22nd St, New York 11, N. Y.

Arc Welding—The process of building up a layer of metal or a metal surface by electric arc welding is discussed under the subjects—Service Required, Service Conditions, Part to be Surfaced, Dimensions and Finish Required. In addition properties of electrodes is given in *Welditectory for Hard Surfacing* obtainable from the Lincoln Electric Co, Cleveland 1, Ohio.

Secondary Racks—*Specifications for Spool Type Secondary Racks* is publication TD-7 issued by Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y. Contents include preferred types, preferred combinations, table of strength, and diagrams with dimensions and code designations of the spool-mounted type racks.

Illumination Levels Indicator—The Calculux is a form of a circular slide rule developed to determine footcandle levels necessary for economic rate of performance of many tasks. It shows levels for productive work, for sedentary work, beneficial changes in existing working conditions and permits planning of future work. Holophane Co, Inc, Dept. of Applied Research, 342 Madison Ave, New York 17, N. Y.

Thermocouple Wire—Tentative Recommended Practice, RP1.1, *Coding of Thermocouple Wire and Extension Wire* gives recommended symbols for the following thermocouple combinations and extension wire: Iron—Constantan (types J and Y); Chromel—Alumel; Platinum—10% Rhodium-Platinum; Platinum—13% Rhodium-Platinum; Copper-Constantan. The 4-page, $8\frac{1}{2}$ x 11 in. publication is available, at $1 to nonmembers, from Instrument Society of America, 1117 Wolfendale St, Pittsburgh 12, Pa.

Storage Batteries—A pocket-size handbook gives instructions on care and operation, maintenance and repairs, parts, and includes technical data on motive-power batteries. The 40-page publication can be obtained from the Gould Storage Battery Corp, Trenton 7, N. J.

Welding Electrodes—Properties of deposited metal, arc welding procedure, parent metal applications and equipment applications are contained in a 8-page pamphlet *Weldirectory for Stainless Steel* issued by The Lincoln Electric Co, Cleveland 1, Ohio.

Aluminum Castings—A 64-page booklet *Aluminum Alloy Castings*, is a composite reprint of 14 articles covering the production and application of aluminum alloy sand and permanent-mold castings. Copies at a price of 50¢ each (no stamps) may be obtained from The Aluminum Association, 420 Lexington Ave, New York 17, N. Y.

Cables—*Cable Operation, 1946* is a joint report which covers operating experience with high-voltage (above 7.5 kv between phases) cable, joints and potheads as reported by 16 contributors who operated a total of more than 14,000 miles of cable. Publication Q-10, at a price of $1.75 to nonmembers in United States, is obtainable from Edison Electric Institute, 420 Lexington Ave, New York 17, N. Y.

Switchgear Diagrams—*The Purpose and Use of Electrical Diagrams Supplied with G-E Switchgear Equipment* defines and explains: One-line diagrams; elementary diagrams; connection diagrams; and interconnection diagrams. This bulletin GET-1293A is available from Apparatus News Bureau, General Electric Co, Schenectady 5, N. Y.

Energy Supplies—*Major Sources of Energy* analyzes nine "continuous" sources: Solar energy, waterfalls, the earth's heat, vegetation, tropical waters, tides, atmospheric electricity, wind and heat pump; also "unrenewable" sources, including fissionable elements and fossile fuels. This 36-page booklet is available from Gulf Research & Development Co, P. O. Drawer 2038, Pittsburgh 30, Pa.

Screw Threads—*Proceedings of Fastener Manufacturers' Symposium* gives background of international agreement, description and analysis of the new standard, and the discussion of its effect on fastener manufacture. American-British-Canadian unified screw threads as applied to bolts, screws and nuts is the main subject of the 100-page book published by American Institute of Bolt, Nut and Rivet Manufacturers, 1550 Hanna Building, Cleveland, Ohio and available at $1.50 per copy.

Radio Listening—Scope of study, use of diary method to check the extent and character of individual listening, a brief summary of comments made by respondents, and significance of findings, in Champaign and McLean Counties, are presented in *Qualitative Analysis of Radio Listening in Two Central Illinois Counties*, Bulletin 68, issued by Bureau of Economic and Business Research, University of Illinois, Urbana, Ill.

Silicone Oils—A technical report has been issued to describe physical properties of all nine GE silicone liquids. A viscosity-temperature chart is included for each grade. Copies of *General Electric Silicone Oils* is obtainable from Chemical News Bureau, General Electric Co, Pittsfield, Mass.

NEMA Standards—Following six standards have been issued: Black Varnished Condenser Paper, Publication 48-137, price 60¢. Yellow Varnished Condenser Paper, Publication 48-138, price 60¢. Yellow Varnished Nylon Fabric, Publication 48-139, price 50¢. Yellow Varnished Silk Fabric, Publication 48-140, price 60¢. Rubber Insulated Power and Control Cables, Publication 49-141, price $3. Mining Belt Conveyors, Publication 49-142, price 50¢. Foregoing standards are obtainable from National Electrical Manufacturers Association, 155 East 44th St, New York 17, N. Y.

CATALOGS • BULLETINS

●OIL CIRCUIT BREAKERS: Catalog 510 describes, with illustrations, the operating mechanism of Type AKE outdoor oil circuit breaker. This 4-page booklet replaces Bulletin No. 63. It includes a list of the electrical characteristics of the equipment. Pacific Electric Mfg Corp, 5815 Third St, San Francisco 24, Calif.

●METAL PRESERVATIVES: Seven new folders on metal preservation and paint durability on metal have been issued. They include the following: "Alodine" (protects aluminum); "Deoxidine" (destroys rusters); "Duridine" (metal cleaner and conditioner); Cold Spray "Granodizing" (protective zinc phosphate coating process for steel); "Lithoform" (makes paint stick to galvanized iron); "Rodine" (used in pickling process); "Thermoil-Granodine" (for protection against rust and wear). Each folder describes a specific metal-treating chemical. American Chemical Paint Co, Ambler, Pa.

●SILICONE FLUIDS: Properties and behavior of the DC 200 silicone fluids are described in a 32-page booklet entitled "Dow Corning Silicone Note Book, Fluid Series No. 3." Illustrations, charts and tables are freely used. Dow Corning Corp, Midland, Mich.

●LIGHTING: "It Happened In Denver's Schools—It Can Happen in Yours," is a 16-page report which explains why every one of Denver's 80 public school buildings was relighted. In addition it states how the project was planned, who helped with the lighting layouts, how the classrooms were redecorated to get the most out of the new lighting equipment, how the fixtures were selected, and other factual data. Day-Brite Lighting, Inc, 5411 Bulwer Ave, St. Louis 7, Mo.

●CONTROLLERS: Bulletin A119 covers Series 500 pneumatic controllers; Bulletin C305 covers the new C500 cycle controller; Bulletin T825, the 500 Series of gages and thermometers and R900 the round chart dynamaster. All these bulletins contain illustrations giving salient features of the equipment. The Bristol Co, Waterbury 91, Conn.

●HYDRO-VOLIFIER: The modern way to clean, stabilize, dehydrate and degasify transformer and circuit breaker oils is described in a 4-page illustrated bulletin. Details of construction and case histories are included in the bulletin. Bowser, Inc, Ft Wayne, Ind.

● LAMP ANNUNCIATORS: A new basic data sheet, giving the fundamental data on lenses, lampholder units and lamp bulbs, has been issued. The H. R. Kirkland Co, Morristown, N. J.

● REGULATOR: In a 22-page booklet the story is told of a rotating regulator, Rototrol, in the steel industry; its functions, its applications and its outstanding accomplishments. Westinghouse Electric Corp, P. O. Box 868, Pittsbugh, Pa.

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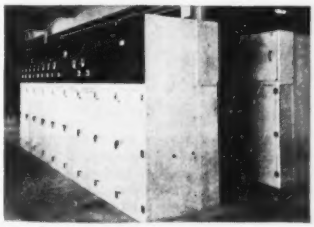

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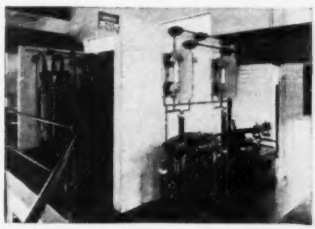

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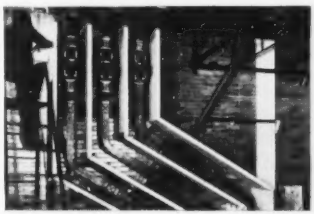

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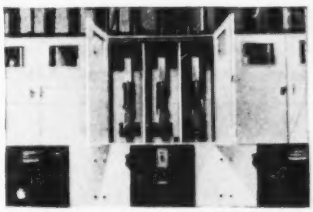

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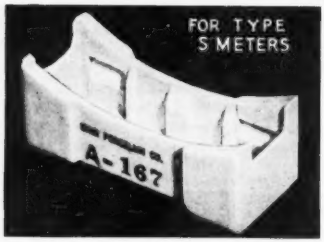

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LETTERS TO THE EDITOR

Lake Mead Silt Volume

To the Editor of ELECTRICAL WORLD:

Technical Notes for Electrical World, Feb. 26, 1949, carried an item on the Hoover Dam-Lake Mead silt-load of one million tons (more or less) every 24 hr. requiring a train of gondolas 300 miles long to haul.

Being curious I attempted to confirm your figures with the results as follows: The U. S. Geological Survey, Water Supply Paper No. 998, page one gives the load as averaging per annum 200,200,000 tons at Grand Canyon. Mr. Dale of the American Railroad Assn., Operating Div., Washington, D. C., gives data on gondolas (hopper) for "70T" and "50T" with capacities (max.) of 80 and 64.5 tons respectively and coupled lengths of 45 and 35 ft. With these basic data the miles of required trains per day follow:

Gondolas, tons capacity:	"50"	64.5	"70"	80
Annual: 200,200,000 Tons;	72.6	56.4	66.6	58.4 miles
Maximum Day: 27,600,000 tons, 1927	3660	2840	3360	2940 miles

Assuming 100 cars trains:

"70" Tons at capacity of 80 tons per gondola.

Annual: A train every 21 minutes would be required. Time for load each gondola would be 12.6 seconds.

Maximum Day: A train every 29.2 seconds would be required with time for loading each gondola 0.292 seconds.

R. S. Goodridge,
Chevy Chase, Md.

(USGS data as interpreted by Mr. Goodridge would require 72 mile-long trains per day throughout the year instead of the 300 we estimated broadly from other data. Either way it's a lot of fill.)—Editors

WEC-Reynolds Supply Of Aluminum Conductors

To the Editor of ELECTRICAL WORLD:

It was with interest that I read your discussion in the ELECTRICAL WORLD some time ago of the contract between the Wisconsin Electric Cooperative and the Reynolds Metals Company to provide additional quantities of aluminum conductor for the rural electric cooperatives. One point in your discussion perhaps calls for some amplification. I refer to the question raised by "one Washingtonian" as to "how one federal agency, REA, could ok an exclusive contract so blandly while another, the Justice Department, wages war on exclusive contracts, notably that between Western Electric and AT&T."

There are, of course, many differences between the WEC-Reynolds transaction and the Western Electric-AT&T combine. The most significant difference, it seems to me, is that in the case of the WEC-Reynolds plan its successful culmination will result in more competition being injected into the aluminum conductor field which has heretofore been monopolistically dominated by one huge corporation. Just offhand it doesn't appear to me that the Western Electric-AT&T tie-up has the result of bringing about more competition.

In regard to the WEC-Reynolds contract, I am glad you pointed out in your article that REA has no connection with it, such as was the case when we undertook to help our borrowers break the pole shortage bottleneck immediately after the war. A good many people overlook the fact that the WEC-Reynolds contract is strictly a contract between the Wisconsin Electric Co-operative (not an REA borrower) and the Reynolds Metals Company. REA obviously has been interested in it because of the promise it holds for supplying aluminum conductor so desperately needed by the rural electric cooperatives. Insofar as we are concerned this interest is certainly not "exclusive". As a matter of fact we have sought for more than a year to point out to any and all the potentialities of the co-op conductor market. But these efforts to assure an increased conductor supply by the aluminum industry had no apparent effect. In fact the waiting period for delivery of aluminum conductor continued to increase. Until WEC and Reynolds came forward no proposal had been made either to us or to our borrowers for stepping up the supply of much needed aluminum.

While the WEC-Reynolds contract is outside our jurisdiction, we ask as a matter of course under terms of the loan contract to approve the materials contracts between WEC and our borrowers. We check and approve every contract between any borrower and an outside agency when use of loan funds is involved.

We sincerely regret that the aluminum conductor industry should, as you say, "shed tears" and "angrily clack dentures". This may well be the way also to describe the sentiments of the rural folk who are still waiting to get electricity. Certainly the case of these people is important and one that puts a tag of urgency on any action that will get the job done.

George W. Haggard
Assistant Administrator
Rural Electrification Administration
Washington, D. C.

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WANTED: LARGE mining company in South America require services of graduate electrical engineer with five years' industrial experience and test experience if possible. Duties include maintenance and installation of electrical equipment in underground mine and surface shops. Equipment consists of electric locomotives, electric drive and control for mine ventilating fans, pumps and hoists; also electrical distribution system, with substations for stepping voltage down from 50,000 to 2300 and 4000 volts. Must be single or single status, age 25 to 35. Liberal three-year contract, transportation. Please reply stating qualifications and salary required to P-8793, Electrical World.

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1—100 HP. Whse, 1300 rpm 2200-440v.
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1—75 HP. General Electric Type KT 900 RPM 440 volt.
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1— 100 HP G.E. 720 rpm 440v, 25 cy. IM.
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50 HP. F.&M. 1800 rpm 220v, 60 cy.

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1—30 HP. 440/1200 rpm General Electric.
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1—1500	G.E.	360	275	2300/4600
1—1250	G.E.	600	275	4150
1—1000	Whse	514	250	4000
1—1000	Cr. Wh.	720	250	2300/4150
1— 800(3u)	G.E.	1200	120/240	2300
1— 500	G.E.	720	600	2300/4150
1— 500	G.E.	720	125	2300/4400
1— 400	G.E.	720	250	2300
1— 400	G.E.	1200	120/240	440
1— 350	G.E.	900	125	415v
1— 250	Whse.	1200	250	440
1— 150	Cr. Wh.	1160	250	220/440
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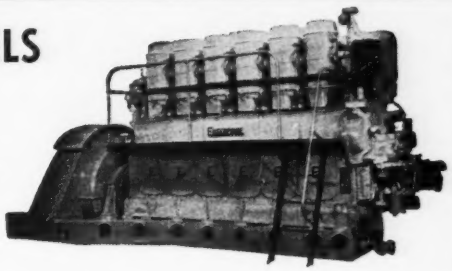

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900	General Motors	12-567	1080	720	200	Buckeye	80	240	600
625	Superior	OS	750	327	125	General Motors	3-268A	150	1200
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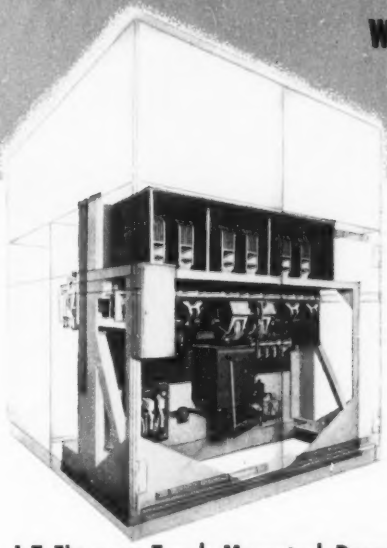
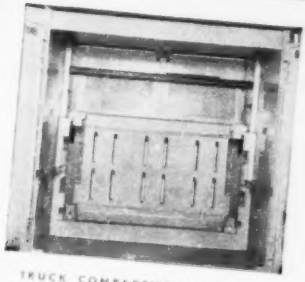
NOW — Increased A-C Circuit Protection at 6000 Amperes with Complete breaker Accessibility!





TRUCK COMPARTMENT DETAILS:

- Construction: sheet-steel panels on all-welded frame.
- Compartment arranged so that circuit breaker is completely enclosed when truck is in compartment.
- Steel compartment doors are double-hinged and can be closed when truck is removed from compartment.
- Safety panel moves forward to cover terminals when breaker is removed — prevents accidental contact with terminals.
- Non-magnetic materials used wherever necessary to prevent heating in structure.

CONTROL MECHANISM

- Access to control mechanism is gained through a small door in main compartment door.
- Mechanism is designed to automatically lock the truck when breaker is in Disconnected Test, or Operating Position.
- Truck can be moved to any of these positions without opening main compartment doors, thus complete protection is given to the operator and the mechanism.
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I-T-E's new Truck-Mounted Draw-Out Type LG Circuit-Breaker for Main, Bus-Tie, and Feeder-Breaker Applications

It's another *Switchgear First* for I-T-E! — a new A-C circuit breaker, rated 6000 Amps. continuous, truck mounted for draw-out installations.

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	PANTOGRAPH-MOUNTED	TRUCK-MOUNTED
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2-, 3-, and 4-Pole. Electrically operated.
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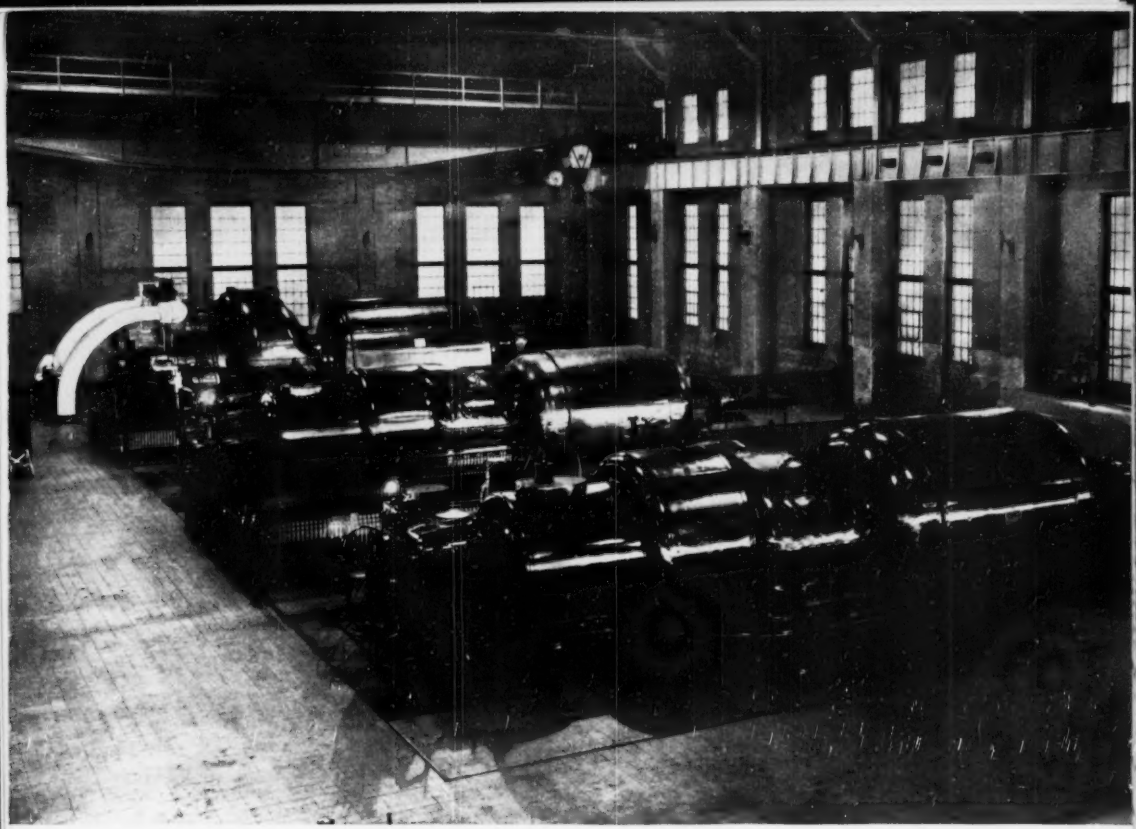

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